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THE

PROCEEDINGS

OF THE

LINNEAN SOCIETY

OF

NEW SOUTH WALES.

FOR THE YEAR

1901.

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CORRIGENDA.

Page 136, line 13—for *E. paludosa* read *E. camphora*.

Page 200, line 25—for *Beyeria vicosa* read *Beyeria viscosa*.

Page 465, line 32 should read—*Syrnola Harrissoni*, Tate & May; from the type. [*S. micra* is a different species, and is not figured].

Page 531, line 22—for *Hasaris diloris* read *Hasarius diloris*.

Page 600, line 3—*for* Lime water gives no precipitate *read* Lime water in excess (20-30 volumes) gives a precipitate.

PROCEEDINGS

OF THE

LINNEAN SOCIETY

OF

NEW SOUTH WALES.

WEDNESDAY, MARCH 27TH, 1901.

The Ordinary Monthly Meeting of the Society was held at the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, March 27th, 1901.

Mr. J. H. Maiden, F.L.S., &c., President, in the Chair.

Mr. WILLIAM T. BALL, Auckland, N.Z., was elected a Member of the Society.

DONATIONS.

(Received since the Meeting in November, 1900.)

Department of Agriculture, Brisbane.—Annual Report for the year 1899-1900: Queensland Agricultural Journal. Vol. vii. Part 6 (Dec., 1900); Vol. viii. Parts 1-3 (Jan.-March, 1900). *From the Secretary for Agriculture.*

Geological Survey, Brisbane—Report on the Permo-Carboniferous Coal Measures of Clermont and Associated Formations (1900). By B. Dunstan, F.G.S. *From the Director.*

Queensland Museum, Brisbane—Annals. No. 5 (1900): Annual Report of the Trustees for the Year 1899 (1900). *From the Trustees.*

The Queensland Flora. Part iii. (*Caprifoliaceæ-Gentianeæ*). By F. M. Bailey, F.L.S., Government Botanist (8vo. Brisbane, 1900). *From the Author.*

Australian Museum, Sydney—Memoir iv. Part 3 (Feb., 1901): Records. Vol. iii. No. 8 (Dec., 1900). *From the Trustees.*

Department of Mines and Agriculture, Sydney—Agricultural Gazette of New South Wales. Vol. xii. Parts 1-3 (January-March, 1901). *From the Hon. the Minister for Mines and Agriculture.*

New South Wales: Fisheries of the Colony—Report of the Commissioners of Fisheries for the Years 1890-1899 (eleven Reports): Report of the Royal Commission appointed on the 20th November, 1894, to inquire and report upon the best Means of Developing the Marine and other Fisheries of New South Wales, &c. (1895). *From the Department of Fisheries.*

Pamphlet: "A Chat on Daffodils." By Peter Barr, V.M.H. (8vo. Sydney, 1900). *From the Horticultural Association of New South Wales, Sydney.*

Royal Anthropological Society of Australasia, Sydney—Science of Man. Vol. iii. n.s. Nos. 11-12 (Dec., 1900-Jan. 1901); Vol. iv. No. 1 (Feb., 1901). *From the Society.*

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Department of Mines, Melbourne—Report *re* Utilization of Brown Coal, &c. By H. C. Jenkins: Report on the Queen, Moliagul, &c., Mines, Moliagul. By S. B. Hunter (1900): Report on the Mount William Gold-field. By H. Herman, B.C.E., F.G.S. (1900). *From the Secretary for Mines.*

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DESCRIPTION OF A NEW SPECIES OF ACACIA.

By J. H. Maiden.

(Plate i.)

Acacia Dorothea, sp. nov.

An erect shrub of several feet, with angular branches, more or less covered all over with appressed white hairs, occasionally rubbed off on the old leaves, very dense on the young shoots. Phyllodia linear-lanceolate, falcate, rather more than 2½ inches long and 4 to 5 lines broad, rarely attaining ½ an inch in breadth, obscurely veined, except the prominent mid-vein, with prominently thickened margins, and frequently with a small oblique or recurved point, the single large marginal gland about halfway between the point and the base. Flower-heads oblong, about 6 to 8 on short pedicels, in stout axillary or terminal racemes much shorter than the leaves. Flowers about 20 in the heads. Calyx small, shortly 5-lobed, very hairy. Petals 5, glabrous or nearly so, more than twice as long as the calyx, united at the base. Ovarium densely hairy. Pods flat, stipitate, generally 1 to 1½ inches long, and about ¼ inch broad, somewhat curved, with thickened margins, much constricted between the seeds, densely covered with soft hairs, especially in the unripe state. Seeds longitudinally arranged, small, ovate, only 2 or 3 or solitary in the few ripe pods seen; funicle folded under the seed, the last fold much thickened.

Mount Wilson (J. H. Maiden, April, 1896, in bud; October, 1899, in flower); Mount Victoria (J. H. Maiden, August and September, 1898, in bud and in flower); near Hartley (J. H. Maiden, February, 1899, in bud); Clarence Siding (J. H. Maiden, September, 1899, in flower, and in April, 1900; J. L. Boorman, December, 1900, with unripe pods; January, 1901, with ripe seeds).

The species is named in honour of my daughter, Acacia Dorothy Maiden (in fulfilment of a long-standing promise)

The affinity of this species lies with *A. rubida*, A. Cunn., *A. obtusata*, Sieb., and *A. amoena*, Wendl.; but it is distinguished from them all by the *oblong flower-head* attaining fully ¼ inch in length, and almost connecting it with the section *Juliflorœ*. Its hairy pods distinguish it also from the allied species.

EXPLANATION OF PLATE.

Fig. 1.—Flowering twig.
Fig. 2.—Showing the oblong flower-heads, best seen in bud.
Fig. 3.--Pentamerous flower, showing the hairy calyx.
Fig. 4.—Pod, showing the constriction between the seed.
Fig. 5.—Seed, with funicle, enlarged.

NOTE ON THE SUBGENUS *SALINATOR* OF HEDLEY.

BY EDGAR A. SMITH, F.Z.S., CORR. MEM.

In the last Part of the Proceedings of this Society (Vol. xxv., p. 511) Mr. Hedley has suggested a new subgeneric name (*Salinator*) for the Australian shell commonly known as ***Amphibola fragilis***, to take the place of *Ampullarina* of authors which he shows to have a different signification from the ***Ampullarina*** of Sowerby.

In his remarks he merely casually refers to the genus ***Ampullacera*** of Quoy and Gaimard, described in 1832*, which included both the genus ***Amphibola*** as restricted by Mr. Hedley, and the subgenus ***Ampullarina***, auct. (= *Salinator*).

The question first of all arises whether there are sufficient grounds for subgeneric separation, and secondly, if this be granted, whether the name *Ampullacera* should not have been used.

It is a recognised custom, where an author has included various forms under one generic title, for his successors to limit the genus, retaining the original name, and to apply fresh terms to the forms considered distinct.

As Messrs. Quoy and Gaimard did not indicate either species in particular as the type of their genus, it is open to any succeeding writer to apply the name *Ampullacera* either to *A. avellana* or to *A. fragilis*, supposing he considers them generically or subgenerically different.

Now, as the species *avellana* was previously, in 1817, appropriated by Schumacher as the type of his *Amphibola*, it could not be retained for *Ampullacera*, and, therefore, it seems to me that Mr. Hedley would have acted more wisely if he had used the latter term for the *fragilis* group of species, instead of further burdening science with a new name.

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* Voy. Astrolabe, Zool. Moll. Vol. ii., p. 196.

Conchologically the two forms are, in my opinion, inseparable subgenerically, and M. Bouvier*, who has studied the anatomy of both, although pointing out differences in the genitalia, does not appear to have considered them sufficient for generic or subgeneric distinction.

In conclusion it may be of interest to point out that the proper name to apply to the New Zealand species is *Amphibola crenata*, as the following synonymy will shew :—

1784—*Limax crenata*, Martyn, Univ. Conch. Vol. ii., pl. 69.
1789—*Bulimus avellana*, Bruguière, Ency. Méthod.† Vers. Vol. i. p. 297.
1790—*Helix avellana*, Gmelin, Syst. Nat.* p. 3640.

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* Bull, Soc. Philom. Paris, ser. 8, Vol. pp. 146-153.

† The correct dates of those works have been kindly supplied to me by Mr. C. Davies Sherborn.

STUDIES ON AUSTRALIAN MOLLUSCA.

PART IV.

(*Continued from Vol.* xxv., *p.* 732.)

BY C. HEDLEY, F.L.S.

(Plate ii.)

FLAMMULINA GAYNDAHENSIS, Brazier.

Helix (Thalassia) Gayndahensis, Braz., Proc. Linn. Soc. N. S. Wales, i. 1875, p. 2.

(Plate ii., figs. 17-19.)

An example from the original lot has supplied the opportunity of illustrating this hitherto unfigured shell. It measures: height, 4 mm.: major diameter, 7 mm.; minor diameter, 6 mm. Without some knowledge of the anatomy, its classification cannot be certain. The consideration of shell characters suggests to me that its place is next *F. delta*, Pfr., as a second member of the subgenus called *Hedleyoconcha* by Pilsbry.*

TRITONIUM SINENSE, Reeve.

Tryon, Man. Conch. iii., p. 20, pl. xi., fig. 85.

This tropical species appears to have escaped notice as an inhabitant of the coast of N. S. Wales. I have seen an adult specimen taken at the Black Rocks, near Ballina, N. S. Wales.

A near ally, *T. caudatum*, Reeve, has already been recorded by Angas† from Port Stephens and near the mouth of the Macleay

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* Pilsbry, Guide to the Study of Helices, 1894, p. 18.

† Angas, P.Z.S., 1877, p. 179.

River. I have seen an adult shell from the Black Rocks, and a young dead specimen was lately found at Balmoral Beach by Mr. J. J. Walker, R.N.

MANGILIA ALTICOSTATA, Sowerby.

Sowerby, Proc. Malacol. Soc. ii., 1896, p. 31, pl. iii., fig. 16.

This species has hitherto been known only from St. Vincent's Gulf, S. Australia. I have lately recognised it in a single beach shell collected by Mr. J. Brazier in the dyke-trough at Hunter's Beach, Middle Harbour.

SCALA MINUTULA, Tate & May.

Tate & May, Trans. Roy. Soc. S. Australia, 1900, p. 95.

This species has been found in N. S. Wales by Mr. H. L. Kesteven, who has shown me an example which he collected at the North Head of Botany Bay. He has since generously presented his specimen to the Australian Museum.

ODONTOSTOMIA VARIANS, Tate & May.

Tate & May, Trans. Roy. Soc. S. Australia, 1900, p. 97.

An example of this species which I collected on Balmoral Beach, Middle Harbour, was identified for me by Prof. Tate.

LIOTIA VENUSTA, n.sp.

(Plate ii., figs. 1-3.)

Shell flattened, widely umbilicate, solid, glossy, white. Whorls four and a-half. Upper ones smooth; the last two with one keel at the periphery and another at a third of the distance between that and the suture; on the last whorl these are beaded (32 beads on the periphery), but on the penultimate they are plain. On the base a keel follows the rim of the umbilicus, and at equal distances three others are disposed between that and the periphery. For minor sculpture there are raised spiral threads between the suture and upper beaded keel. The spaces between the other keels are latticed by oblique threads in the line of growth, which appear again within the umbilicus. Aperture oblique, ovate; lip very little thickened and expanded. Major diam., 4·9; minor diam., 3·8; height, 2·2 mm.

Hab.—Darnley Island, Torres Straits. One specimen taken by Mr. J. Brazier in 30 fathoms.

Type.—To be preserved in the Australian Museum.

This species is not like the typical *Liotia*; it possibly belongs to *Microtheca*, a genus not sufficiently elaborated by its author for satisfactory use.

Liotia devexa, n.sp.

(Plate ii., figs. 4-6.)

Shell turbinate, whorls in transverse section nearly square, widely umbilicate, very solid, dull. Colour creamy white, whorls four, the upper two unsculptured, the last descending steeply and suddenly. The whole surface is densely covered by fine, close, radiating threads. Periphery flattened, with a keel at the upper and lower angles, the superior crenulated. Outside the deeply impressed suture runs a row of denticules. Base flattened, the abrupt margin of the aperture scalloped. Aperture semilunate, very oblique, with two massive lips, one within the other. Major diam., 4·5; minor diam., 3·5; height, 3·3 mm.

Hab.—Torres Straits; dredged by Mr. J. Brazier, in 12 fathoms.

Type.—To be preserved in the Australian Museum.

Teinostoma vesta, n.sp.

(Plate ii., figs. 14-16.)

Shell subdiscoidal, solid, smooth, glossy, white, and widely umbilicate. Whorls four, parted by a furrowed suture, last whorl broadened near the aperture, above ascending on the previous whorl, below with incipient transverse ribs. Spire a little elevated. Umbilicus infundibuliform, sharply angled at the margin. Aperture oval, a little thickened within. Major diam., 3·15; minor diam., 2·3; height, 1·5 mm.

Hab.—Darnley Island, Torres Straits; several examples dredged by Mr. J. Brazier, in 30 fathoms.

Type.—To be preserved in the Australian Museum.

CYLLENE LACTEA, Adams & Angas.

Adams & Angas, P.Z.S., 1863, p. 422; 1867, p. 191.

(Plate ii., fig. 10.)

A drawing is now presented of this hitherto unfigured species. The original is 13 mm. in length and 6·5 in breadth. It was identified by Mr. Brazier, and was dredged by him in 8 fathoms off the inner North Head, Sydney Harbour. The colour is not always as described by the specific name. Some shells are marbled with pale brown, and have below the suture alternate white and dark brown spaces.

CANTHARIDUS DECORATUS, Philippi.

This common shell varies a little;* some specimens are more sharply keeled and some are broader in proportion to their height than others; the spiral lines of granules differ in their development, and the colouration is not always the same. Owing partly to this, but chiefly to insufficient material, it seems to me that several names have been applied to it. After diligent study I can find no essential difference between the descriptions and figures in the Conchylien Cabinet of *Trochus decoratus* (p. 59), *T. fragum* (p. 257), and *T. pyrgos* (p. 297), all of Philippi. Indeed, my chief difficulty in uniting these is to believe that so careful an author could thus err. No subsequent conchologist has recognised all three species. For instance, Smith sees *T. decoratus* in the Sydney shell, but refers to *fragum* as only known to him in literature; again, Pilsbry recognises the Sydney shell as *T. pyrgos*, but *T. decoratus* is for him a name in books.

The description of *Thalotia zebrides* by A. Adams is without measurement or locality, and is quite useless for discrimination. Angas, doubtless informed by Adams, thus determined and redescribed the common Sydney shell.* Pilsbry doubtfully subordinates *T. zebrides* to *Cantharidus pyrgos*.†

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* As noticed by Reeve, Conch. Icon. xiv., 1863, *Ziziphinus*, Pl. v., f. 36.

These names appeared in the following order:—

Trochus decoratus, Philippi, Zeitsch. f. Mal., July, 1846, p. 102. Locality unknown; from Gruner's collection.

Trochus fragum, Philippi, Zeitsch. f. Mal., 1848, p. 106. Locality unknown; also from Gruner's collection.

Trochus pyrgos, Philippi, Zeitsch. f. Mal., 1849, p. 189. Locality Australia; from Hanley's collection.

Thalotia zebrides, A. Ad., P.Z.S., 1851, p. 173. Locality unknown.

Canthiridus decoratus, Ad. & Ang. (P.Z.S. 1864, p. 37), is identified by Prof. Tate as *Gibbula tiberiana*, Crosse, 1863. It is submitted that the different rendering of the generic name of that species permits *Cantharidus decoratus*, Philippi, to be used for the Sydney shell.

CUSPIDARIA LATESULCATA, Ten. Woods.

Neæra latesulcata, Woods, P.L.S. N.S.W. ii., 1877 (1878), pp. 123, 124.

(Plate ii., figs. 11-13.)

That an illustration of this hitherto unfigured species might be supplied, Dr. J. C. Cox has kindly lent me his original series studied by the Rev. J. T. Woods. The valve represented is 31 mm. long. *C. latesulcata* was taken in Torres Straits by Prof. A. C. Haddon.‡

Smith, who writes the name, *N. latisulcata*, marks the species as one he personally examined and includes it in his section A. or *Neæra* proper.§

Dall has pointed out that because *Neæra* is preoccupied in entomology, *Cuspidaria* must necessarily be adopted.‖

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* Angas, P.Z.S., 1867, p. 215.

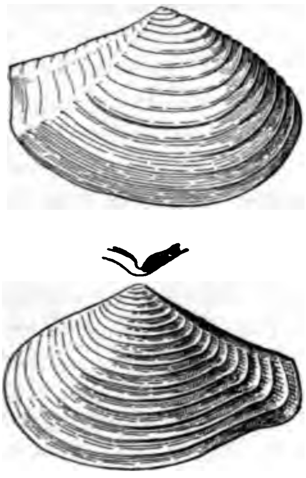
† Pilsbry, Man. Conch. xi., p. 144.

‡ Melvill & Standen, Journ. Linn. Soc. Zool. xxvii., 1899, p. 202.

§ Smith, Chall. Report, Lamellibranchiata, 1885, p. 35.

Cuspidaria tasmanica, Ten. Woods.

T. Woods, Proc. R. Soc. Tasmania, 1875, p. 27.



Cuspidaria tasmanica.
Fig. 20.

For comparison with the foregoing species I include illustrations of this hitherto unfigured species, derived from an authentic specimen kindly lent to me by the Rev. H. D. Atkinson. (Fig. 20).

Lima brunnea, n.sp.

(Plate ii., figs. 7-9.)

Shell thin, translucent, small, shaped like an axehead, with no gape, very inequilateral. Posteriorly the shell is truncate for almost the whole height, the truncated portion being sharply and deeply infolded. A curve of half a circle is approximately described by the ventral and anterior margin. Colour, pale brown. Sculpture: the whole surface is evenly covered by fine, close, radiating riblets, which are microscopically beaded, diverge from a median parting and are occasionally disjointed by concentric growth lines. Cardinal area triangular, overhung by the incurved beak and sharply defined by a ridge above. Hinge line short. Auricles almost obsolete, cartilage narrow, in an obliquely descending, shallow sulcus, which barely undulates the hinge margin. Inside polished, faintly tinged with purple; the margins denticulated by the radiating riblets. Height, 8 mm.; length, 6 mm.; breath of conjoined valves, 4 mm.

Hab.—Only known within Sydney Heads; dredged alive in 8 fathoms off Green Point, Watson's Bay, by Mr. J. Brazier; found dead on Chinaman's Beach, Middle Harbour, by myself, and at the inner South Head by Mr. H. L. Kesteven.

Type.—To be preserved in the Australian Museum.

I have had the pleasure of showing this remarkable little shell to Prof. Tate, who confirms me in regarding it as new. The feeble ligament and tightly closed valves suggest to me that this Lima is no swimmer.

ON THE CHALLENGER STATION, 164 B.

One of the Australian "Stations" of the cruise of H.M.S. *Challenger* is known as 164 B. It is situated a little distance east of Sydney in a depth of 410 fathoms. Here the expedition is reputed to have obtained a quantity of shells. Most are known from this haul alone.

Of these are:—*Neæra angasi*, *Lima murrayi*, *L. australis*, *Pecten challengeri*, *Nucula umbonata*, *N. dilecta*, *Tellimya subacuminata*, *Solarium atkinsoni*, *Scala distincta*, *Mitra miranda*, *Marginella carinata*, *M. brazieri*, *Cancellaria exigua*, *Pleurotoma challengeri*, *P. crossei*, *P. hoylei*, *P. watsoni*, *Odostomia fischeri*, *O. consanguinea*, *O. constricta*, *Bulla incommoda*, *Cylichna ordinaria* and *Lepeta alta*, all of E. A. Smith; *Trochus glyptus*, *Trophon carduelis*, *Fusus pagodoides* and *Nassaria campyla*, of R. B. Watson; *Turritella smithiana* and *T. crenulata* of Miss J. Donald.

Except for their presence in this haul the remainder of the species are known only from the North Atlantic Ocean, namely:—*Rissoa deliciosa*, Jeffreys; *Dentalium ensiculus*, Jeffreys; *D. panormitanum*, Chenu; *Cuspidaria teres*, Jeffreys; *Poromya neæroides*, Seguenza; *Cadulus propinquus*, Sars (or *C. curtus*, Jeffreys); *Dentalium capillosum*, Jeffreys; *Scaphander gracilis*, Watson; *Scissurella crispata*, Fleming; and *Seguenzia carinata*, Jeffreys.

Mr. E. A. Smith, who has dealt with this collection, remarks on it as follows:—"The specimens in question were picked out of samples of sea-bottom, which have been examined since the reports on the Gasteropoda and Lamellibranchiata by the Rev. R. Boog Watson and myself respectively were published. Mr.

Watson, who examined the Gasteropods, questioned the correctness of the locality from the presence of these Atlantic forms, and was inclined to believe that some mistake must have occurred. I also at first held the same view; but as Dr. Murray is convinced that no such error in the locality could possibly exist, I feel bound to withdraw that opinion."*

Probably most naturalists will fail to reconcile the facts with the conclusion quoted. Personally I cannot believe that an extensive series of marine shells could be taken in the neighbourhood of Sydney, which on the one hand should contain no Pacific species, but on the other have so large a proportion as one quarter of North Atlantic forms. A consultation of the "Summary of Results" of the Challenger expedition, strengthens the presumption that these shells are foreign to Australian seas. For it is written (i., p. 574) that at station 164 B., the operations consisted of sounding and putting over the trawl which came up "with a few specimens." In fact, the dredge was not put down at all. If the record of these specimens be correct, then one of the most profitable hauls of the voyage, rich in species and exceptionally rich in individuals, was made without using a dredge and appeared to the officer-in-charge as "a few specimens."

With reference to *D. ensiculus*, Pilsbry† writes :—"Taking into account the association of species of other genera, it seems to us quite incredible that these forms actually occurred at the station alleged. It is more likely that a locality label became misplaced."

Following this suggestion, it occurred to me that "164 B." might be a mistaken label for "64." Examination of the record of the latter station gives some support to this hypothesis. For Challenger Station 64 is in mid-Atlantic, between Bermuda and the Azores, with a depth of 2,700 fathoms. Here the dredge was put down "to get a good sample of the bottom" and "about a cwt. of ooze" was secured.[*] I can find no further history of this hundredweight of mud in the Challenger publications, and I venture to suggest it as a probable origin of the 164 B. shells. Every reason against the Australian habitat of these shells becomes an argument in favour of their Atlantic habitat. Firstly, my hypothesis satisfies the claim made by *Rissoa deliciosa* and following ten species, to transfer the whole collection from the Pacific to the Atlantic; secondly, the field books of the expedition show that the Atlantic Station 64 yielded a great haul but no published results; whereas the Pacific Station 164 B. gave an insignificant haul with great published results; thirdly, it is expressly stated by Smith that the 164 B. shells "were picked out of samples of sea-bottom;" the Atlantic sample was a cwt. of ooze, the Pacific sample was what returned upon the sounding lead.

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* E. A. Smith, Proc. Malac. Soc. i., 1894, pp. 59, 60.

† Pilsbry, Man. Conch. xvii. p. 122.

This reasoning may or may not be sufficient grounds for incorporating the 164 B. shells in the Western-North Atlantic fauna, but I submit that it justifies the elimination of the series from the Australian fauna.

The period of disturbed records includes a previous haul. At Station 163 A., off Twofold Bay, N. S. Wales, depth 120-150 fathoms, the *Challenger* trawled several large shells of which no notice appeared in the subsequent reports. Angas, on Brazier's information, mentions[†] that *Murex cervicornis*, Lamarck; *Cypraea umbilicata*, Sowerby; *Voluta papillosa*, Swainson; and others were taken there.

As corroborative evidence of the correctness of the locality of these 164 B. shells, Smith cites the supposed finding alive of the Mediterranean species *Euthria cornea* by Mr. R. C. Rossiter at Wagap, New Caledonia. I wrote to Mr. Rossiter to inquire about this and he replied:—10th February, 1901, "that he had *not* found it alive, but had recived it from a correspondent." A

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[*] Summary of Results, Chall. Ex. i., 1895, pp. 252-3.

[†] Angas, P.Z.S., 1877, p. 179.

French military post is stationed at Wagap and the soldiers there come straight from Marseilles. The inference is obvious.

EXPLANATION OF PLATE II.

Figs. 1-3.—***Liotia venusta***, Hedley; from different aspects.
Figs. 4-6.—***Liotia devexa***, Hedley; from different aspects.
Figs. 7-9.—***Lima brunnea***, Hedley; from two aspects with details of hinge.
Fig. 10.—***Cyllene lactea***, Adams and Angas.
Figs. 11-13—***Cuspidaria latesulcata***, Ten. Woods; from different aspects.
Figs. 14-16—***Teinostoma vesta***, Hedley; from different aspects.
Figs. 17-19—***Flammulina gayndahensis***, Brazier; from different aspects

GEOLOGICAL NOTES ON KOSCIUSKO, WITH SPECIAL REFERENCE TO EVIDENCES OF GLACIAL ACTION.

By Professor David, B A., F.R.S., Richard Helms, and E. F. Pittman, Assoc. R.S.M.

(Plates iii.-x.).

I. Introduction.

In the appendix to this paper a list is given of the principal works relating to the above subject as well as to general evidences of glaciation in Cainozoic time in the Southern Hemisphere. Briefly the history of the geographical and geological exploration of Kosciusko is as follows:—

In 1840 Count P. E. de Strzelecki mounted the Alps and called one of the highest peaks Kosciusko, from its fancied resemblance to the patriot's tomb at Cracow (53).

In 1846 Mr. T. S. Townsend, formerly Deputy Surveyor-General in New South Wales, examined the Kosciusko region, and later ran a traverse line along the main dividing line between the waters of the rivers Murray and Snowy (3, p. 227).

During 1851-52 the late Rev. W. B. Clarke geologically examined the Kosciusko region, which he named the "Muniong Range," and for the first time a definite reference is made to evidence there of past glacial action (3).

Mr. Clarke states that "Probably in earlier times glaciers did form; for I saw more than one unmistakable *bloc perché*, a mass resting on upturned edges of strata." Again he states (*op. cit.*, p. 230), "But I am persuaded that formerly true glacier ice was formed on the Muniong, and I have always thought that the effect of it may have produced a kind of *gold moraine* in places, where auriferous veins came into contact with ice."

In 1855 the late Baron Ferdinand von Müller explored the Kosciusko region, chiefly botanically. He speaks of "glaciers" and "ice masses" at Kosciusko, but really refers not to true glacier ice but to snow masses which are characteristic of Kosciusko in winter, and which Mr. Clarke aptly describes thus (*op. cit.* p. 225):—"The snow itself was not exactly in the condition of that which I saw on the glaciers of Mont Blanc, and which is called "névé," nor was it strictly "neige;" it partook of the characters of both, and though not lying on ice but on the rocks, was certainly in a transition state, being partially consolidated. It had been, I doubt not, often partially thawed and re-congealed, the snows of many winters contributing to it. Hence its imperfect crystalline structure."

In January, 1885, Dr. R. von Lendenfeld made a cursory examination of the Kosciusko Plateau, spending a couple of days near the summit (11, 12). Although he did not actually observe ice-grooved rock surface, nor striated boulders nor moraines, he nevertheless concluded from the general aspect of the surface of the granite above the altitude of 5,800 feet, that the Kosciusko Plateau had at one time been glaciated from its highest points (over 7,000 feet), down to that level.

During 1889 and 1893 one of us (Mr. Richard Helms) visited the Australian Alps and found very definite traces of glaciation in the form of moraines, and exhibited to this Society an ice-scratched block from Kosciusko (6). The conclusion arrived at in a subsequent paper was that the ice which glaciated Kosciusko came down at least as low as 5,200 feet above the sea. It is suggested that the numerous small circular lakes in the Monaro region, not far from the Kosciusko Plateau, and lying at altitudes of only about 3,000 feet, may also be of glacial origin (7).

In 1895 Mr. J. B. Jaquet, A.R.S.M., F.G.S., examined and reported upon a part of the Kosciusko Plateau (9). Mr. Jaquet did not see any definite traces of glacial action in the part of the plateau visited by him, and as a matter of fact in the localities examined by him such traces are not conspicuous.

In 1897 the Rev. J. Milne Curran made a detailed examination of the greater part of the Kosciusko Plateau and embodied the results in a paper to this Society. He concluded that evidences of the former presence of moving glacier ice in the region examined by him were wanting (4, 5).

During the same year Messrs. A. E. Kitson, F.G.S., and W. Thorn examined the Kosciusko Plateau, but not sufficiently far north to come within reach of the principal areas, where the glacial evidences now described in this paper exist (10). They conclude, however, that there are evidences of glacial markings at Mount Etheridge, not far from the summit of Kosciusko (10, p. 369).

During February and March of this year we examined a large portion of the Kosciusko Plateau in company with Mr. F. B. Guthrie, F.C.S., and on these occasions found such clear evidences of ice-action as places the former existence of glacier ice at Kosciusko absolutely beyond dispute.

II. General Geological Features.

The section (Plate vi.) accompanying this paper illustrates our views as to the general geology of the region examined by us. At Cooma a gneissic granite traversed by coarse veins of pegmatite prevails. The folia dip in a general direction of about E. 10° N. at 65°. These gneisses differ materially from the gneissic granite of Kosciusko. The Cooma gneisses are very much crushed and strongly foliated, and, as mentioned, are traversed by veins of pegmatite, whereas the gneissic granite of the Kosciusko Plateau is only slightly foliated, and is devoid of the very coarsely crystalline pegmatites, although containing occasional veins of a hard, fine-grained aplite. The gneisses continue from Cooma towards Jindabyne for about 7½ miles, with smallflows of Tertiary olivine basalt capping it at 5½ miles and 6¼ miles. Beyond 7½ miles the micaceous gneissic rocks give place to sedimentary rocks, apparently part of the series of Lower Silurian radiolarian rocks observed further on towards Jindabyne. At 8½ miles towards Jindabyne there is a strong outcrop of these sedimentary rocks.

At 9 miles granite of the Kosciusko Plateau type first makes its appearance. It has the general aspect of being newer than the gneiss of Cooma. An actual junction, however, between the two was not observed. This granite continues, with occasional cappings of basalt and Tertiary gravels at the points shown on the section to about half a mile beyond Berridale, a total of 21 miles beyond Cooma. At the latter spot there is a sharp junction line between this granite and some black chiastolitic shales and radiolarian cherts. The altitude of this junction line on the main road is about 2,530 feet. The chiastolite slates and shales here dip N. 15° W. at 70°. At 22¾ miles an interesting lake, Lake Coolapatong, is seen about half a mile to left of the road. One of us (Mr. Helms) has suggested that it may be of glacial origin. Its altitude is approximately 2,400 feet.

At Barney's Ridge, from 24 miles to 27 miles, 15 chains from Cooma, there is a great development of radiolarian cherts and shales. As these are striking in the direction of Stockyard Creek, Byadbo, where Mr. J. E. Carne, F.G.S., has discovered, in rocks lithologically identical, numerous Lower Silurian graptolites (47). There can be little doubt, we think, that these rocks too at Barney's ridge are Lower Silurian. This supposition is much strengthened by the recent discovery by Mr. W. S. Dun, Palæontologist to the Geological Survey of New South Wales, of abundant casts of radiolaria in the graptolite shales of Byadbo, similar to the casts in the Barney's Ridge cherts.

The latter, moreover, closely resemble the Lower Silurian graptolitic cherts and shales of Mandurama in New South Wales, in which one of us (Mr. Pittman) has discovered and described Lower Silurian graptolites.

The chalcedonic pseudomorphs after radiolaria in the cherts at Barney's Ridge vary from 0·75 mm. to 0·150 mm. in diameter. By far the greater number are exactly 0·115 mm. in diameter. The casts are all more or less spherical.

It is obvious that the sedimentary rocks at Barney's Ridge form a basin bounded by granite on the east and on the west sides.

From the point previously mentioned, 27 miles and 15 chains on the road from Cooma to Jindabyne, the typical Kosciusko granite replaces the Lower Silurian rocks, and continues, more or less, without interruption to the Kosciusko Plateau.

The Kosciusko Plateau rises abruptly from the valley of the Crackenback River to an altitude of a little over 5,000 feet (about 5,200 feet) at Boggy Plains up to 6,000 feet at Pretty Point (top of Point) and culminates at an altitude of 7,328 feet at the summit of Kosciusko, where Mr. Wragge's Meteorological Observatory now stands.

The plateau is for the most part formed of gneisssic granite very full of dark enclosures. These are mostly not basic segregations or secretions, but fragments torn from older rocks, some of them being fragments of micaceous quartzite and quartz schist. The folia of the granite strike about S.S.W. and N.N.E., dipping chiefly to E.S.E. at varying angles, perhaps 70° being near the average.

The granite is traversed by dykes of pyroxene-amphibolite rocks, passing by decomposition into a chlorite rock. There are also present whitish veins of hard aplitic granite, which seem of somewhat later origin than the mass of the granite. One of these veins is shown in Plate vii

The granite is also traversed by dykes of olivine-basalt containing enclosures of granite. A large dyke of this kind may be observed at Strzelecki's Pass (Lendenfeld), close to Russell's Tarn (Helms), a short distance from Mount Townsend. Another on the main dividing ridge above Garrard Tarn (Harnett's Lake), and a third on the west side of Lake Merewether (Blue Lake). (Plate iii.). A very interesting dyke rock was discovered by us at a point about one-quarter of a mile up Evidence Valley (Valley of Blue Lake) from its junction with the Snowy River. The dyke is about 7 feet wide and strikes E. 5° N., and is vertical. It is almost entirely formed of the minerals nepheline and ægirine. Mr. G. W. Card, A.R.S.M., F.G.S., determined the latter mineral for us. The nepheline is in beautifully developed idiomorphic to hypidiomorphic crystals, showing perfect rectangular or hexagonal outlines in thin sections. Sanidine is present in long delicate acicular crystals, singly twinned. The rock is therefore essentially a phonolite. Sedimentary rocks, as shown on the map (Plate iii.), are represented by slates, phyllites, and felspathic quartzites, which are very possibly of Lower Silurian age. No fossils, however, macroscopic or microscopic were observed in them by us. We would add that the frequency of earthquake shocks in the neighbourhood of Cooma (see appendix, 51) indicates that crustal cracking and orogenic movement is probably still in progress in this region.

III. Evidences of Glacial Action.

These may be grouped as follows:—

1. Smoothing of rock surfaces.
2. *Roches moutonnées.*
3. Grooved and striated rock surfaces and striated boulders.
4. Erratics and perched blocks.
5. Terminal and lateral moraines.
6. Lakes and tarns of glacial origin.

As regards No. 1, Professor Lendenfeld has already noted that the rocks of gneissic granite at the Wilkinson Valley, near Kosciusko, and at "Tom's Flat" (Thompson's Flat), near Pretty Point, are smoothed and hollowed-out in a manner very suggestive of glacier action (11, 12); and one of us (Mr. Helms) has already commented on the fact that from Mount Kosciusko down to the level of Boggy Plains, the granite surface over a large area shows evidence of having been planed down by glacier ice (7).

The recent examination by us of part of the Kosciusko highlands has confirmed these opinions as to the general smoothing of the rock surfaces in the Kosciusko region between altitudes of 7,150 feet and 5,600 feet.

In a paper of an introductory character like the present, it may be convenient to describe these evidences in the order in which a traveller following the usual route from Cooma *viâ* Jindabyne and Boggy Plains to Kosciusko would be likely to see them. We have, however, departed from this rule in the case of localities where the evidence of glaciation is obscure, such areas being treated of last. If, therefore, the evidences at Boggy Plains, Pretty Point, and the flats near Porcupine Ridge and Betts' Camp be passed over for the present, it may be assumed that the observer has reached the right branch of the Snowy River near its source. At the point where the track to Kosciusko from Betts' Camp crosses the right branch of the Snowy River there is a little morainic material in the valley bottom with a few tarns lying higher up.

At about 30 chains N.N.W. of this point, more in the direction of the dray track than of the bridle track, the observer may notice two moraines of rough angular granite blocks trailing down from a spur of the Etheridge Range towards the Snowy River. If this spur be now followed in a south-west direction for half a mile, so as to rejoin the bridle track to Kosciusko, the observer will see a fairly well marked lateral moraine just before the crest of the ridge of the Etheridge Range is reached, at a point 1¼ miles E. 33° N. from the Kosciusko Observatory.

The altitude of the upper end of this moraine is about 6,660 feet, which is only a trifle lower than the upper end of the moraine to be described later near Townsend's Pass (Lendenfeld) in the Snowy Valley, these two being the highest moraines observed by us in the Kosciusko region. Further along the bridle track to Kosciusko a number of hummocky rock masses, having all the appearance of *Nunatakr*, form the capping of the Etheridge Range. The altitude at the base of these is about 6,910 feet. The rocks up to the base of the *Nunatakr* show evidence of having been much smoothed; and as grooved rocks were seen by us near Mount Townsend up to a level of at least 6,850 feet, it is only reasonable to conclude that the ice surface near these *Nunatakr* stood at an altitude of at least 6,910 feet. Half a mile further along the bridle track is Ramshead Pass, about one-quarter of a mile E.S.E. from the Kosciusko Observatory. The rocks at this pass, 7,000 high, show evidence of having been smoothed, probably by ice, from the bottom of the pass up to a level of 7,150 feet, this being the extreme upward limit to which possible ice-action was traced by us in the Kosciusko Plateau. From Ramshead Pass (Lendenfeld) a view may be obtained of the first of the glacial lakes, Lake May (or Cootapatamba, or Kosciusko).

Lake May (*Lake Cootapatamba*, *Lake Kosciusko*).—This lake bears S. by E. from the Kosciusko Observatory, and is distant from it about three-quarters of a mile.

An examination of the valley which descends from Ramshead Pass to the lake shows throughout ice-smoothed rock surfaces and moraine material with occasional ice-scratched blocks. The last mentioned are rare, as might have been expected in a locality where the dominant rock is a coarsely crystalline gneissic granite, very unsuited to receiving or retaining glacial markings. Such few boulders as exhibit glacial markings are of felspathic quartzite, and were derived from the east side of the valley.

The lake which is about one-quarter of a mile long and has a maximum depth of about 17 feet, is bounded, at its lower end, by a very well marked terminal moraine. The latter is slightly crescent-shaped with the convex side of the crescent directed down the valley.

From its west extremity the moraine trends E. 10° S. for 6 chains, then E. 8° N. for 6 chains, then N.E. for about 8 chains, passing in this last direction into lateral moraine. The best ice-scratched blocks obtained by us were at the base of the terminal moraine near its east end.

While the length of this terminal moraine does not exceed one-quarter of a mile, its height, at this east end, is a little over 40 feet, and near the centre about 75 feet. The blocks in the moraine are nearly all granite, and are mostly from 3 feet up to about 8 feet in diameter; a great number being of this larger size. Occasionally blocks were observed up to 10 or even 12 feet in diameter.

It was only on the east side of the moraine that fragments of phyllite and quartzite were found. This is accounted for by the fact that these sedimentary rocks form the bed rock only on the eastern side of the valley, as shown by the geological sketch map (Plate iii.). The general strike of these sedimentary rocks is about S. 8° E., and is, therefore, nearly parallel with the trend of the valley.

It is probable that these quartzites are identical with those upon which is situated the striated rock surface near Townsend's Pass, about two miles distant, in a N. by E. direction, and to be described later.

At a total of about 22 chains below the south end of Lake May is a second terminal moraine obviously older than the preceding. Like the latter it is crescent-shaped, being thickest at the middle and slightly looped down the valley (Plate v., fig. 1).

It is about 18 chains in length as terminal moraine proper, and is extended further, in a N.E. direction, as lateral moraine.

The level of the creek where it has cut through this lower terminal moraine, at the lower side of the embankment, is 95 feet below the top of the embankment immediately to the west, and is 180 feet below the level of the western end of this moraine, which is its highest point. As there can be little doubt that the height of the central part of this moraine has been lowered a good deal by denudation, it may fairly be assumed that at its centre it was formerly, perhaps, at least from 20 to 30 feet higher than at present, which would make its thickness from 100 feet up to about 120 feet. If, however, this moraine was originally as high at the centre as at the sides, its height at the centre would have been originally 180 feet.

As regards the development of the glacier ice in this valley it is evident from the duplication of the terminal moraine embankments and from the space which separates them, that there have been two distinct epochs or phases there of glaciation, the older glacier being about one quarter of a mile longer than the newer and having a larger terminal moraine.

There must have been a long pause of the glacier snout at the present position of the lower moraine.

Subsequently the glacier retreated more or less rapidly up the valley until its front rested upon the present site of Lake May. There was then a second long pause during which the second terminal moraine embankment, about one-quarter of a mile long and 75 feet in greatest thickness, was slowly built up. Then came a second retreat of the glacier up the valley, perhaps more gradual than the first, and the ice melted back to near Ramshead Pass without leaving any further definite terminal moraine embankment, although its retreat is marked by deposition of a certain amount of irregularly distributed moraine matter along the bottom of the valley, with a little lateral moraine along its eastern side.

As regards the thickness of the ice during the later of these two glaciations, an examination of the smoothed granite surfaces on the west side of this valley shows that the valley must have been glaciated up to a level of at least 150 feet above the present level of Lake May, and as the moraine dam at this lake is about 75 feet high, a further thickness of perhaps that amount might be added for the former depth of the glacier ice at this epoch. The ice, therefore, in this valley was probably at this time at least 200 feet in thickness.

During the earlier phase of this valley glaciation, when the lower terminal moraine was formed, as the moraine is now 95 feet high and was formerly at least 120 feet high, possibly 180 feet, the ice at this terminal moraine must at one time have been probably from 150 to 200 feet thick, and higher up the valley cannot have been much less than 300 feet thick. A cursory examination of the rocks for a short distance below the level of this older terminal moraine showed that they were more or less smoothed, apparently by ice, for some distance down the valley. Definite evidence, however, of ice action was not observed below the lower moraine dam, but it would be premature, in the absence of detailed examination, to conclude that no glacial evidences exist at a lower altitude.

The Wilkinson Valley.—The highest part of this valley, just beneath Mount Townsend, was not examined by us, and the following remarks apply only to the portion of it which lies within a distance of about a mile below the above limit.

Evidences of glacial action are not so fresh or distinct there as in other localities, about to be described, at Kosciusko. Neither grooved nor ice-scratched rocks were observed, but the granite surface was seen to be smoothed and hollowed-out in a manner which cannot well be explained except by ice-action, as Professor Lendenfeld has already argued (12, p. 47). In the small valley, the head of which is separated by a very low divide from the Wilkinson Valley, and which lies immediately below and due west of the Kosciusko Observatory, several low moraine banks were noticed by us. The two principal ones bear about 315° and 333° respectively from the Kosciusko Observatory. They are not more than from 10 to at least 15 feet in height.

The Snowy Valley (left branch).—As already mentioned, near Ramshead Pass, which divides the head of the Snowy River from the Lake May Valley, the granite shows evidence of ice-wear up to a level of about 7,150 feet, that is up to about 150 feet above the level of Ramshead Pass. If a descent be made into the head of the Snowy Valley from this pass, it will be seen that a large amount of moraine material extends for several hundred feet above the valley bottom. This is deposited chiefly on the west side of the valley. Smoothed surfaces of quartzites were observed at three places between the head of the valley and the small recent landslip, 1¼ miles northerly from Ramshead Pass. Beyond this point the valley bends sharply to the east, but if the observer continues on a northerly course for a little over one-quarter of a mile further so as to cross the Snowy and ascend towards "Townsend's Pass," to the south of Lake Albina, he comes upon a beautifully preserved remnant of a lateral moraine, already alluded to by one of us (Mr. Helms, 7, p. 358). (See Plate x., fig. 2).

This moraine trends in a S.E. direction from Townsend's Pass

Kosciusko Observatory, and is a mile and a half distant. It forms a conspicuous feature in the landscape, bearing a striking resemblance to a railway embankment. Its trend is E.S.E. and W.S.W., its upper end lying in the latter direction. It is nearly a third of a mile in length, the exact measurement being about 32 chains.

Beyond this limit, however, it has been considerably denuded, and for a further distance of over one-quarter of a mile it is represented merely by irregular hummocks of more or less redistributed moraine material. Its summit is flat, from 20 to 30 yards wide, and has a slope to the E.S.E. of 1 in 4½ for the first 100 yards, and 1 in 5 for the remainder of the distance.

The moraine is composed chiefly of angular and subangular blocks of granite and slate with a certain amount of interstitial sandy material.

The fragments of granite are usually from 3 inches to 1 foot in diameter and are mostly subangular or rounded. Blocks up to 2 feet in diameter are not infrequent. Three angular granite erratics were observed by us in this moraine, respectively measuring 6½ ft. x 5 ft. x 4¼ ft., 12 ft. x 4 ft. x 3 ft., and 14 ft. x 8 ft. x 5½ ft. As a rule the granite boulders show neither grooves nor striæ, the coarsely crystalline character of the rock and its easy weathering being unfavourable to the forming or preserving of such glacial markings. A block, however, now exhibited, of fine-grained aplitic granite (which we dug *in situ* out of the moraine) has distinct glacial grooves on its under surface.

The fragments of slate (phyllite) in the moraine vary from 2 inches up to 6 inches and rarely 1 foot in diameter. They are mostly subangular, and out of some hundreds of specimens examined the majority exhibit irregular glacial cuts, grooves, and coarse scratches. The material of this micaceous phyllite is wholly unsuited to receive or retain fine striæ. The upper surfaces of the slate fragments in this moraine seldom, if ever, exhibit either scratches or grooves, all traces of such having been effaced through weathering.

That the whole moraine, as well as the rock surface to the N.E. on which it originally reposed, has undergone an appreciable amount of erosion, since the disappearance of the last of the glaciers is proved by the evidence shown in Plate iv.

Careful measurements convinced us that not less than 9 feet (measured vertically) of moraine and 10 feet of phyllite have been eroded since the retreat of the ice, and this has led to the formation of the small gully which bounds this lateral moraine on the N.E. A total lowering of the surface, therefore, to the extent of at least 19 feet has taken place since the disappearance of the last of the ice. The evidence afforded by the erosion of this small gully, at the side of the lateral moraine, was about the best we were able to obtain as to the approximate date of the latest glaciation at Kosciusko. It is, of course, impossible to estimate the exact time-value of this erosion, but in this respect we would quote the statistics recently obtained by Mr. C. C. Brittlebank, F.G.S., for the rate of erosion of the Myrniong Creek Valley, in Victoria.*

Mr. Brittlebank summarises (*op. cit.* p. 321) the results of his observations as follows :—

Rate of erosion in Werribee River and tributary creeks, Victoria.

Basalt	... 0·02 inches in 5 years	= 1 inch in 250 years.
Silurian (Slates—T.W.E.D.)	... 0·03 „ „	= 1 „ 166⅔ „
Granite	... 0·04 „ „	= 1 „ 125 „
Glacial	... 0·05 „ „	= 1 „ 100 „

(Compact Permo-Carboniferous mudstone with small glacial boulders—T.W.E.D.)

The moraine at Townsend's Pass, Kosciusko, would no doubt have been eroded much more rapidly than any of the rocks studied by Mr. Brittlebank, and the time needed for its erosion would be relatively so small as to be negligible; and it has accordingly been omitted from the following calculations. As regards the phyllites in view of their highly cleaved and jointed character and their soft micaceous nature, it is probable that erosion, in their case, too, may have progressed at least as rapidly as in the case of the Permo-Carboniferous glacial beds studied by Mr. Brittlebank, and if further allowance be made for exposure to frosts on Kosciusko, and for the great range of temperature to which the rocks there are exposed, it may reasonably be assumed that the erosion at Kosciusko was more rapid than at the Werribee River. At the same time the fact must not be lost sight of that for about six months in the year the moraine at Townsend's Pass is under snow, during which time erosion and weathering would be at a minimum.

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* Austr. Association Adv. of Science, Melbourne, Jan. 1901. "The rate of erosion of some river valleys." By C. C. Brittlebank. Geol. Mag. No. 433. New Series, Dec. iv. Vol. vii. July, 1900, pp. 320-322.

Even if the phyllites at the above moraine were eroded at the same rate as the Permo-Carboniferous beds of the Werribee River, that is at the rate of 1 inch in 100 years, at least 10 feet of phyllite having been eroded since the latest glaciation, this would obviously need for its accomplishment 10 x 12 x 100 years = 12,000 years. For reasons, however, stated above it is probable that these figures are too high. This supposition is confirmed by the freshness and good state of preservation of the glaciated surfaces of granite even in highly exposed positions in the Kosciusko Plateau, not more than one-sixteenth of an inch to 1 inch having been removed by weathering. The original glaciated surface, however, is rarely preserved, except where it has been protected by a covering of moraine.

If the gully to the N.E. of the lateral moraine be followed down from the end of the moraine embankment towards the Snowy River, a small striated rock surface may be noticed of hard slate, and about a couple of yards square, about three chains below the base of the moraine embankment; and at a point still further down towards the Snowy River 7½ chains below the foot of the moraine, and a few feet above the bed of the creek, is another small striated rock surface. The rock in this case is a hard quartzite. It is a few feet above the east bank of the creek, and the magnetic bearing from it to the Kosciusko Observatory is 200° 20′.

The surface measures about 8 feet long by 2 feet wide at the centre, and 1 foot wide at either end. It trends S. 5° E. and N. 5° W., and its surface dips S. 10° W. at 10°. The whole surface has been ground smooth, and is faintly striated. A portion of this is now exhibited.

The striæ run N. 30° W., and S. 30° E., the strike side being on the N.W., as might have been expected, as the valley here falls from the N.W. towards the S.E.

At a point nearly one-quarter of a mile south-east of the preceding is another striated rock surface of quartzite, of the nature of a small *roche moutonnée*. The striæ run from N.W. to S.E.

The altitude of this is about 6,340 feet, whereas that of the previous glaciated surface of quartzite is about 6,400 feet. The level of the summit of the lateral moraine at its lower end is 6,510 feet, while that of the extreme upper end is 6,720 feet. The Snowy Valley below the 6,340 feet *roche moutonnée* was not examined by us in detail, excepting between a point due west of Charlotte's Pass, at the junction of Club Lake (Harnett's Lake, or Garrard Tarn), and the junction lower down of Evidence Valley Creek with the Snowy River. Near the junction of Club Lake Creek with the Snowy River there is a well-marked terrace of what appears to be redistributed moraine material on the right bank of the Snowy River; and several ice-scratched boulders were picked up by us on the left bank of the Snowy, just above its junction with Evidence Valley Creek, the latter having its source in Lake Merewether (the Blue Lake).

About 5,520 feet is the altitude by aneroid of the lowest spot were such ice-scratched pebbles were found by us. This is the lowest level at which any ice-scratched pebbles were observed. It is of course possible that these were not *in situ*, but had drifted down from higher levels. At the same time the gneissic granite along this part of the Snowy Valley shows almost certain evidence of ice-wear, down to at least as far as the junction with Evidence Valley Creek. The distance to this point from Townsend's Pass is about 4½ miles, and we think it may safely be inferred that the Snowy Valley was at one time filled with ice to at least as far down as this.

Before considering the possible thickness of ice in this valley it will be advisable to describe the important collateral evidence in the Lake Albina Valley.

Lake Albina Valley.—The finest glaciated rock surfaces hitherto observed by us are in the Lake Albina Valley.

The upper end of the valley, where the evidences of past glacial action are pronounced, is only about three-quarters of a mile in length, the slope of the bottom of the valley being gradual for this distance, but below the north end of Lake Albina plunging steeply down towards the Murray River. Traced to its commencement the valley is found to begin on the north side of Townsend's Pass (the pass over the main Dividing Range between the Murray and the Snowy River watersheds, due south of Lake Albina). The altitude (by aneroid) of this pass is 6,650 feet.

From the base of the northern slope of this pass to the northern end of Lake Albina the bottom of the valley is filled with hummocky masses of moraine material, surmounted by large granite erratics up to 20 feet in diameter, and it appeared to us to contain more morainic material than any other of the valleys examined by us on the Kosciusko Plateau, with the exception, perhaps, of the Evidence Valley.

The moraine drift has been carried beyond the north end of Lake Albina, and to some height up the eastern slope of the valley, numerous large erratics of granite having there invaded the area of the slate (phyllite) formation. These can be seen in the distance in a photograph by one of us (Mr. E. F. Pittman). (Plate x., fig. 8).

Several small tarns are situated near the upper end of the moraine débris, south of Lake Albina. Lake Albina itself owes its origin to a moraine dam. This has been cut through by the creek, and huge boulders derived from it now fill the bed of the water course at lower levels, the creek north of this moraine plunging down rapidly towards the Murray River. The lake is a little under one-quarter of a mile in length by from about 3 to 5 chains in width. It appears to be fairly deep in places in proportion to its size. Its surface, as measured by aneroid, is about 6,340 feet above the sea. The moraine stuff in the neighbourhood of the lake has been much redistributed, and is partly masked by a covering of recently slipped slate-rubble along its eastern shore. Under these circumstances ice-scratched blocks would not be expected to occur, except very sparingly, and as a matter of fact none were observed by us. The moraine material hides the granite surface from view for the most part up to a level of about 150 to 200 feet above the Lake, but from this level up to the very summit of the ridge connecting Mount Townsend with the main Dividing Range, the steep, and in places almost precipitous, granite surface shows abundant and beautiful evidence of having been intensely glaciated. Projecting corners are rasped off, and more or less deeply grooved. Even sheltered recesses have not escaped the abrading action of the ice, and the grooves and striæ are so fresh on some of them as to appear to be of quite recent origin. Seven more or less extensive grooved surfaces were observed by one of us in an hour's examination of this western side of the valley. The positions of these are shown on the plan, and their altitudes range from 6,530 feet up to 6,820 feet. The last level is within 30 feet of the top of the ridge, separating the Lake Albina Valley from the Wilkinson Valley.

It is quite evident from the way in which the rocks have been ground down on the summit of the ridge that ice of considerable thickness must at one time have passed over it.

The finest grooved pavement observed by us is situated at a point bearing due west of the south end of Lake Albina, and 15 chains distant.

There is a smaller grooved pavement about 10 feet below the larger pavement. The larger one measures about 28 yards from N. to S., and about 25 yards from E. to W. The surface has been ground down to a nearly uniform level, is nearly horizontal and is deeply grooved, the grooves running in perfectly straight lines across the platform in a direction E. 15° N. They are nearly at right angles to the gneissic structure of the granite, and many of them are at least 50 feet in length, and are cut to a depth of one-half to one inch. These grooves form the most incontrovertible evidence as to the grinding action of moving glacier ice. If the observer sights along these grooves in a direction E. 15° N. he will see that they point direct to the large polished *roche moutonnée* on the west shore of Lake Albina, near its southern end, at the point where the lake is so contracted as to be almost divided into two. This beautiful grooved pavement had to be photographed by one of us under rather disadvantageous circumstances, as the sun was shining straight down the grooves, so that they cast scarcely any shadow. The photograph nevertheless gives a fair idea of what part of the pavement is like (Plate x., fig. 1); the pavement must, however, be seen in order to be properly appreciated. The surface is slightly weathered, just sufficiently so to remove the striæ, while the deep grooves, and even some of the shallower, are retained. One very large groove was observed to trend E. 33° N., thus making an angle of about 16° with the general trend of the grooves on the west side of Lake Albina Valley, viz., E. 17° N.

Some of the larger grooves every here and there showed traces of having been slightly pitted as though the block of rock, which acted as the graving tool, had dug in more deeply at such points, joggling as a chisel sometimes does in planing iron.

Nowhere, in the part of the Kosciusko Plateau visited by us, was the intenseness of the glaciation more apparent than in this Lake Albina Valley, it being obvious that the ice not only furrowed out the bottom of the valley, but that it moved in thick, heavy masses over the top of the high ridge separating the Lake Albina Valley from the Wilkinson Valley. The minimum thickness of the ice in the Lake Albina Valley may be estimated from the difference in level between Lake Albina and the top of the glaciated ridge to the west of it, Lake Albina being about 6,340 feet above the sea, and the top of the ridge 6,850 feet; the ice in this valley must have attained a thickness of at least 500 feet. As, however, the top of the ridge itself has evidently been heavily glaciated, this implies that the ice on top of this ridge must have been probably not much less than 100 feet in thickness.

If this were so, as seems most probable, the ice would have been 600 feet thick in the Lake Albina Valley, and its surface close upon 6,950 feet above the sea. As already mentioned the bases of the *Nunatakr* of the Etheridge Range are about 6,908 feet high. Now interesting conclusions necessarily follow from this. As Townsend's Pass is only 6,650 feet high, part of the Snowy Valley glacier may have come over the top of Townsend's Pass, the ice at the Pass being perhaps at one time 200 feet or even 300 feet thick. Similarly at Adams' Pass (between the Snowy Valley and the Wilkinson Valley), the level of which is only about 6,587 feet, the ice must have escaped from the Snowy Valley ice sheet into the Wilkinson Valley below in masses which, at Adams' Pass, were probably at least 250 feet, perhaps 350 feet or more in thickness.

An interesting problem now suggests itself in connection with the glaciation of this ridge between the head of the Wilkinson Valley and Lake Albina, viz.: in what direction did the ice move which so powerfully glaciated the western granite slopes of the Lake Albina Valley up to the top of the ridge? The mean trend of the grooves on the seven glaciated surfaces specially observed is E. 17° N. and W. 17° S. Now did the ice move from the east end or from the west end? If from the west, it must probably have been supplied by the overflow from the Mt. Townsend glacier, which may have overpowered the western part of the ice coming over Townsend's Pass from the Snowy Valley glacier. If it moved from the east, it probably was derived from the Snowy Valley glacier, extended via Townsend's Pass into the Lake Albina Valley, and overflowing the dividing ridge between Lake Albina and the Wilkinson Valley, so as to reinforce the Wilkinson Valley glacier. The carry of the material in the moraine of the Lake Albina Valley suggests a westerly movement of the ice, as while the junction line between the granite and slate nearly coincides with the trend of the Lake Albina Valley (N. & S.), the area west of this line being granite, and that to the east slate, the granite erratics have invaded the slate area, but no slate erratics were noticed as having trespassed into the granite area.

Here, however, the fact must be remembered that the carry of moraine material, especially superficial moraine, as distinct from ground moraine, usually indicates the direction of ice movement during *later* phases of glaciation when the ice, of perhaps, originally, a *mer de glace*, has through reduction in volume been split up into a number of small glaciers, the direction of movement of which has had to conform to the trend of the valleys, whereas the ice of the *mer de glace*, of the earlier phase of glaciation, may have radiated out from its centre of movement more or less independent of the physical features of the underlying rock surface. Judged by the phenomena of "strike-side" and "lee-side" alone, it appeared to one of us (Professor David) that the ice which produced the grooved pavements in the Lake Albina Valley probably moved from the east towards the west. Further observation, however, will be necessary before this interesting question can be settled.

We are now also in a better position to estimate the maximum thickness of the ice in the Snowy Valley, at the time when the ridge from Mount Townsend, west of Lake Albina, was being glaciated.

If the surface level of the ice at Ramshead Pass was not less than perhaps 7,150 feet, as seems probable, it would have been possible for it to have had a fall of 250 feet to the top of the ridge west of Lake Albina, even if it be assumed that the ice on that ridge was at least 50 feet thick. This would give a fall (the distance being two miles) of in round numbers 1 in 42, that is an angle of inclination for the surface of the glacier of 1½°. It is doubtful, however, whether ice will flow at such a low angle of slope as 1½°, 3° being usually about the minimum angle of surface slope observed in moving ice.* .

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* The Great Ice Age.

If, therefore, the glaciation of this ridge was the work of the Snowy River glacier or ice sheet, the surface of the sheet, if its inclination was 3°, must have been probably at its starting point, if situated close to Kosciusko Observatory, as high as 7,450 feet, that is, as the level of the Observatory is 7,328 feet, over 100 feet above the level of the Observatory, probably a far-fetched hypothesis.

The culminating point, however, of the ice sheet on the Kosciusko Plateau, during the maximum glaciation, need not necessarily have coincided with the present highest point of the land, and may have lain at some point between the Observatory and Lake Albina. In this case the ice in the Snowy Valley may have been about 650 feet to 700 feet or more in thickness opposite Townsend's Pass.

If, on the other hand, the ridge near Lake Albina was glaciated by ice coming from the direction of Mount Townsend, such ice at a fall of 3° would barely have overflowed Townsend's Pass, the level of which is 6,650 feet, the distance from the glaciated ridge being half a mile, and its level 6,850 feet. The distance from Mount Townsend to the glaciated ridge is about half a mile, the level of Mount Townsend 7,260 and that of the ridge 6,850 feet. At a fall of 3°, that is 278 feet per mile and consequently 140 feet per half-mile, on the assumption that the ice was 50 feet thick on top of the glaciated ridge, this would bring the top of the ice below Mount Townsend to a level of 7,040 feet, which is a by no means improbable height for it to have attained.

In this case, which seems the less hypothetical of the two assumptions, the ice in the Snowy River Valley need not have been thicker than about the difference in level between Townsend's Pass and the bottom of the Snowy Valley opposite to it, viz. 300 feet. Whichever hypothesis be adopted, the thickness of ice in the Lake Albina Valley during the glaciation of the ridge west of Lake Albina would be the same, viz., about 500 feet. This agrees closely with the thickness of the ice in the Lake

Merewether (Blue Lake) Valley during the maximum development of the local glacier, as will appear presently.

Lake Merewether (Blue Lake) and Evidence Valley (Helms), to below Hedley Tarn.—Splendid evidences of past glacial action, including the largest and most complete moraine as yet observed in this region, are to be seen at the above locality.

If the area be approached from the west, from the direction of the main Dividing Range, moraine material with ice-scratched fragments of slate (phyllite) may be seen at an elevation of about 6,530 feet at a point about 20 chains W. of the S. W. end of Lake Merewether. Up to this same level also the granite rocks show evidence of having been planed down by ice-action; and a few feet lower, at about 6,500 feet, they exhibit distinct glacial grooves.

Further east, at 12 to 15 chains west of Lake Merewether, the surface of the gneissic granite is most wonderfully grooved and dressed in a manner which could only have been accomplished by a thick mass of moving glacier ice (see Plate vii.).

The level of this rocky promontory at the spot photographed is about 6,260 feet.

It affords a fine and impressive piece of evidence as to the former presence of moving glacier ice.

Though the granite surface has been somewhat weathered since the glaciation, so that all striæ have disappeared, the grooves remain, and in many cases are in a very good state of preservation. For every foot in width of granite surface, measured at right angles to the trend of the grooves, there are from 4 to 5 grooves. The grooves are from 1 inch up to 6 inches in width, and from ¼ inch up to about 1½ inches in depth. At the spot mentioned above they run in a direction of 140° (that is S. 40° E., is the lee side) and preserve an almost absolutely straight course irrespective of the ups and downs of the granite surface, their trend being straight towards the large moraine which bounds Lake Merewether (the Blue Lake) on the south. Even small vertical faces of granite, opposed to the path of the ice, are deeply grooved. The grooves cross the planes of foliation in the granite at a wide angle, as the latter trend N.N.E. and S.S.W., whereas the grooves run nearly N.W. and S.E.

In Plate vii., the white vein of euritic granite is parallel to the planes of foliation, and the plate shows that obviously the grooves in the granite make a wide angle with the foliation planes. If the gully be followed down to the edge of Lake Merewether the grooves may still be traced on the sloping surface of granite close to the lake shore, and it is obvious that they dip below the surface of the water, the level of which is about 6,150 feet.

In every case it is obvious that, in this vicinity, the N.W. is the strike side, and the S.E. the lee side.

If now a northerly course be followed towards the head of the main valley, it will be noticed that the valley very nearly follows the junction line between the slate and granite (see map, Plate iii.). Slate erratics are found in places resting on glaciated surfaces of granite. One of these measured 5 feet × 3 feet × 4 feet, and in several cases typical perched blocks may be seen, one of which is shown in the photograph exhibited, taken by one of us (Mr. Pittman).

At a quarter of a mile above the Blue Lake, a small terminal moraine crosses the valley, slightly breached by the creek at its west end. It is about 10 chains long and trends in a W.S.W. and E.N.E. direction, and is of no great height. It obviously forms one of the last embankments left by the glacier as it retreated to the head of the valley. Its level is about 6430 feet.

At about a quarter of a mile still higher up the valley on its eastern side, and about 12 feet above the level of the creek, is a small surface of quartzite, ground smooth and striated in two directions, viz., N. 12° W. and S. 12° E. and W.N.W. and E.S.E.

If, now, we return to Lake Merewether, it will be noticed that the water flowing out of it escapes through a breach in the terminal moraine, at a level of about 6,150 feet. The terminal moraine extends from the outlet of the lake in a direction about S. 35° W. for about 15 chains, and for about 10 chains in a direction N. 10° E. from the east side of the outlet. The top of the moraine rises to a level of 6340 feet, about 160 feet above the surface of Lake Merewether. The exact depth of the lake is not known, but it is thought by local residents to be not less than 40 feet in its deepest part, in which case the terminal moraine is probably about 200 feet in height.

It is difficult, however, to draw the line (if any exists) between this terminal moraine and the remarkable moraine now to be described. If the spur to the west of the outlet of Lake Merewether be ascended further to the west, it is found to lead up to one of the most interesting glacial features in the whole Kosciusko region, a wonderfully perfect moraine, even more like a huge railway embankment than the smaller one already described near Townsend's Pass. This remarkable feature has already been referred to by one of us (Mr. Helms) in an earlier paper (7, pp. 357-358).

This moraine is about 29 chains in length, measured along the top of the ridge, its width at the top being uniformly about 16 yards. Its trend from its western end, where it abuts against the junction line between the slate and granite, is first E. 5° S. for 15 chains, then E. 7° S. for 14 chains. It is bounded on either side by steep slopes, its summit is nearly level, and its altitude is about 6,550 feet, that is just 400 feet above the level of the surface of Lake Merewether. The whole amount, however, of the material between these levels is not moraine, as to the S.W. of Lake Merewether the grooved granite surfaces can be traced up to a level of 6,280 feet, where they disappear under the moraine. The remainder, therefore, of the slope between 6,280 feet and 6,550 feet, in all a thickness of 270 feet, may be looked upon as moraine, so far as the northern slope of the moraine is concerned.

As regards the southern slope, grooved surfaces of granite outcrop the levels up to 6,330 feet, so that on this side the moraine material may not be more than 220 feet in thickness. The number of beautifully glaciated boulders in this moraine is remarkable. A cart-load of such boulders could be collected from the moraine by a couple of men in half an hour. The blocks of rock in the moraine are mostly of granite, but slate and quartzite fragments are numerous. The last-mentioned, of course, retain the striæ best. Two of these are now exhibited. (See Plates viii.-ix.).

The blocks are mostly from about 9 inches up to 1½ feet in diameter, occasionally as much as 5 feet. All the fragments of quartzite and slate examined showed glacial markings.

If this moraine be viewed from a distance of three-quarters of a mile to the S.W., it will be seen that it is apparently confluent with the closely crowded group of terminal moraines immediately below Hedley Tarn. It was not clear to us as to whether it should be regarded as a lateral, median or terminal moraine. The grooves on the glaciated granite surface immediately N. of the moraine trend, as already stated from N. 40° W. towards S. 40° E., whereas the general trend of the moraine is W. 6° N. and E. 6° S., so that the ice which glaciated the granite beneath the moraine appears to have moved at an angle of about 45° to the general trend of the moraine. More observation is needed for the correct interpretation of the mode of origin of this remarkable and beautifully preserved moraine.

About one-quarter of a mile below the outlet to Lake Merewether, the grooves on some of the large blocks of granite in the ground moraine trend S. 35° E., and at a point a little further down the valley, and about 300 yards above the upper end of Hedley Tarn, and a few chains to the S.W. of the creek flowing from Lake Merewether to Hedley Tarn, the surface of the granite, where it emerges from beneath the morainic material, shows abundant evidence of having been powerfully ground down and grooved by moving glacier ice. The grooves may be traced right up the shoulder of the ridge to the west of Hedley Tarn to an altitude of about 6,380 feet, whereas the level of Hedley Tarn is about 6,110 feet. This shows that the glacier ice was at least as thick as the difference in level between these points, viz., 270 feet.

As, however, the rocks are deeply grooved up to 270 feet above Hedley Tarn, allowance must be made for a further thickness of grooving at the highest levels. Some idea of what this thickness was may be formed from the height of the adjacent E. and W. moraine previously described, its altitude being 6,550 feet, that is 480 feet above Hedley Tarn. It may therefore safely be assumed that the ice was at least 400 feet, perhaps 500 feet thick, at the time when the glacier extended from Mount Twynam to Hedley Tarn, a distance of one and one-half miles.

The small boulder exhibited was picked up by one of us with its scored surface resting on the grooved surface of the granite beneath at a point about 100 feet above the level of Hedley Tarn. Hedley Tarn, like Lake Merewether, owes its origin chiefly to a terminal moraine, or rather to what appear to be four closely packed terminal moraines. It is much shallower than Lake Merewether. Its general appearance is shown on the photograph exhibited; the granite promontory on the left being grooved up to the highest limit shown in the photograph. The nature of the terminal moraine dam is shown. The terminal moraine has four ridges, each doubtless marking a pause in the retreat of the glacier. They are slightly curved, with the convex side directed down the valley. They are formed almost entirely of blocks of slightly foliated granite, from one foot or so up to 10 or 15 feet, or even more, in diameter. There is not now much sandy material between the blocks, which, on the lower side of the moraines, facing the Snowy River, form a rugged belt of huge boulders, difficult to traverse even on foot, the deep hollows between being largely concealed from view by a growth of shrub. This moraine has already been described by one of us (R. Helms, 7, p. 359).

The base of the lowest bank of this moraine material lies at a level of about 5,810 feet, whereas the top of the same bank has an altitude of 5,950 feet, showing a thickness for this lowest and oldest moraine of about 140 feet.

This level of 5,810 feet marks the lowest limit down to which undoubted evidence of glacial action has been found as yet in the Kosciusko region, about 1,500 feet below the summit of Kosciusko, the altitude of which is 7,328 feet.

An examination, however, of Evidence Valley further down to its junction with the Snowy River Valley showed that the rocks were much worn down in a manner very suggestive of glaciation ; and as already mentioned, a few ice-scratched blocks were found there by us down to an altitude of 5,550 feet. The level of the junction of Evidence Valley with the Snowy Valley is about 5,500 feet. At a point a little over one-quarter of a mile up Evidence Valley from its junction with the Snowy is the interesting dyke of phonolite referred to earlier in this paper.

Betts' Camp, Porcupine Ridge, Thompson's Flat, Pretty Point, Boggy Plains, and Valleys of Spencer's Creek and Perisher Creek. —From Betts' Camp to Porcupine Ridge and thence *viâ* Thompson's Flat to Pretty Point, and on to Boggy Plains, there occur at frequent intervals small flats, 200 to 300 yards wide, the floors of which are strewn with small boulders, tightly packed in thin sandy clay, resting on a smooth surface of granite. To the S.E. these flats, are terminated abruptly by slopes towards the Crackenback River, so steep as to be almost precipitous. In a N. by W. direction they slope gradually down to the creeks which flow into the Snowy River.

The smoothing of the granite surface is not apparent at the sides of these flats or on the intervening hills.

On the assumption that these smoothed surfaces are of glacial origin, it would appear that the glaciation must have been of somewhat high antiquity, as the granite on the intervening hills is weathered into large domes, pinnacles and tors. As regards the boulders which are plentifully distributed over the floors of these flats, they were in almost every case such as might have been derived either from the local granites or enclosures in them, or from dykes traversing the granite. A pyroxene amphibolite, in places nearly approaching a hornblende andesite, and passing through decomposition into a chlorite rock, was of frequent occurrence. Clear evidence was obtained that they were derived from dykes intersecting the granite. A great number of these boulders, which varied from a few inches up to 2½ ft. × 1 ft. 8 in. × 1 ft. 3 in. in diameter, were examined by us. In most cases they were far too much weathered to retain the original surface of erosion, and those which did seldom exhibited any grooves or scratches.

In the case, however, of one boulder, found by us *in situ* near Porcupine Ridge, a small cut, apparently of glacial origin, was noticed on its under surface. Marks were also observed on a few blocks of similar rock at Thompson's Flat, but as the latter were not *in situ* and had been moved in the bed of a mountain creek the evidence is not of much value.

Amongst other rocks represented in these detrital deposits, besides the prevailing granite, were felspar porphyries, basalt, and mica schist, in addition to large subangular blocks of quartz; the largest seen, which bears about N. 10° W. from Pretty Point, about half a mile distant, measuring 4 ft. x 4 ft. x 1½ ft.

None of the blocks examined by us from the shallow prospecting shafts near Pretty Point or Boggy Plains exhibited definite glacial cuts or striæ.

With regard to the general evidence of a possible extensive glaciation along the whole Kosciusko Plateau as far down as Boggy Plains (the altitude of which is about 5,220 feet), great caution should, in our opinion, be exercised in interpreting the phenomena. The wide flats strewn with small and large boulders and the smoothed granite rocks bounding such flats are very suggestive of ice-action. If of glacial origin, they may have been formed by ice choking up the Snowy Valley and seeking an escape in an easterly direction into the watershed of the Crackenback River.

One of us (Mr. Helms) has elsewhere advocated this view, and is still of the same opinion, the evidence being given by him in considerable detail in his paper to the Linnean Society of New South Wales (7, pp. 354-356).

Professor Lendenfeld had previously published a general statement as to a former universal glaciation of the Kosciusko Plateau. Two of us (Professor David and Mr. Pittman), while admitting that there is nothing in the evidence inconsistent with the interpretation put upon it by Mr. Helms and Professor

Lendenfeld, would prefer to await more definite evidence before concluding that the whole of the Kosciusko Plateau was formerly buried in ice down to the level of Boggy Plains, or even lower. At the same time the fact may be repeated here that there is positive evidence that the glacier, descending from Mount Twynam *viâ* Evidence Valley and Hedley Tarn towards the Snowy River, came down to a level of about 5,800 feet above the sea; and there is probable evidence of ice-action in this part of the Snowy Valley even as far down as to about 5,500 feet above the sea.

The level of Pretty Point is about 5,990 feet and that of Boggy Plains about 5,220 feet, so that the hypothesis of a wider and older glaciation extending to Boggy Plains does not demand the lowering of the limit which moving ice may have reached very much below that to which we have positive evidence that it did actually descend.

If the Kosciusko Plateau ever underwent such a *mer de glace* glaciation on a small scale, in Cainozoic time, probably the most enduring evidence of it would be in the form of *moraine profonde*, or even a terminal moraine some distance down the Snowy River Valley. A more extended examination of this region may yet lead to the discovery of such evidence.

IV.—CORRELATION OF THE EVIDENCES OF GLACIAL ACTION AT KOSCIUSKO WITH THOSE OBSERVED ELSEWHERE

Before drawing certain provisional deductions which are given in our summary of this paper, it is necessary to review briefly similar evidences of glaciation in Cainozoic time in other parts of the Southern Hemisphere. We have omitted the evidences, described by some authors, from Victoria, as in the opinion of Professor J. W. Gregory the evidences of Post-Tertiary glaciation in such parts of Victoria as he has already examined are doubtful. References, however, to the chief papers referring to this subject are given in the appendix.

(1) *Tasmania.* —Mr. C. Gould, formerly Government Geologist, Mr. C. P. Sprent, formerly Surveyor-General, and Mr. R. M. Johnston, the present Government Statistician, have seen evidences of glaciation in Tasmania in Cainozoic time. The last-named authority has recorded these evidences in his large and detailed work on the Geology of Tasmania, as well as in the Papers and Proceedings of the Royal Society of Tasmania (23, 24).

Mr. T. B. Moore, M. E. J. Dunn, F.G.S., Mr. A. Montgomery, M.A., and Messrs. Graham Officer, B.Sc., Lewis Balfour, B.A., and E. G. Hogg, M.A., have all recorded clear and indisputable evidences of glaciation in Tasmania in late Cainozoic time (26-29).

There is some question as to (*a*) how much of the evidences are Cainozoic and how much Permo-Carboniferous, and (*b*) as to how low down the glaciation extended.

All are agreed that the western highlands of Tasmania in late Tertiary or Post-Tertiary time supported extensive glaciers, which have left memorials of their former presence in the form of lakes, tarns, terminal moraines, striated and grooved rock-surfaces and glacially transported erratics.

Mr. R. M. Johnston has published a map to show the directions in which the ice moved in the Lake St. Clair district (25).

It is also generally agreed that the evidences of this Pleistocene or Pliocene glaciation are clear from levels of 4,000 feet or upwards, down to at least 2,000 feet above the sea (27).

Mr. A. Montgomery, M.A., the late Government Geologist of Tasmania, makes the following statement (26) :—

"I think we must come to the conclusion that the whole of the deep gorges among these western mountains now occupied by the head waters of the Pieman, Henty and King Rivers, have been at no very distant period of time occupied by rivers of ice. The erratic blocks noted by Mr. R. M. Johnston in the Mackintosh Valley bear out this conclusion. . . . If we allow that the deep valleys at the head of the Pieman were once occupied by glaciers, we must admit that *the ice came down to within 500 or 600 feet of the present sea level* [the italics are ours], for these gorges are very deep, or, perhaps, we should rather say, to points which are now that distance above the sea, for of course it is quite possible that there has been elevation or subsidence of the land as a whole since the ice age."

Mr. Montgomery also concludes (*op. cit.* p. 162) that the glaciation could not have been very ancient, basing his inference on the excellent state of preservation of the greenstone erratics and glaciated rock surfaces near East Mount Pelion, among the branches of the River Forth.

Mr. T. B. Moore maintains that the ice during part of this late Cainozoic glaciation came down to within 150 feet of sea level, probably even to sea level on the west coast of Tasmania, near Macquarie Harbour.

He records the occurrence of large ice-worn boulders near Upper Landing on King's River, which flows into Macquarie Harbour, and also at the neighbouring locality of Harvey's Creek, the altitute being only 100 feet above the sea.

He states that between Strahan and Lyell there is a well-marked moraine, quite distinct from and far newer than the Permo-Carboniferous glacial beds, and that a "Giant's Kettle" occurs in connection with this moraine.

Messrs. Officer, Balfour and Hogg, however, consider this moraine to be of Permo-Carboniferous Age (29).

Whether the age of this glaciation at so low a level be Permo-Carboniferous or Post-Miocene, it would appear from Mr. Montgomery's observations that the glaciation near East Mount Pelion at elevations of 2,000-3,000 feet has taken place in Post-Tertiary, possibly in recent geological times.

Messrs. Officer, Balfour and Hogg (*op. cit.* p. 129) state that as the "last of the previous winter's snow had not melted on Olympus by the end of January, it is not necessary to assume a very extensive fall of temperature to account for perpetual snow in these regions."

(2) *New Zealand.*—Dr Haast, Captain F. W. Hutton and Dr. R. von Lendenfeld, and others, have described evidences of what Captain Hutton terms a glacier epoch, as distinct from a glacial epoch in New Zealand (30-33). It is generally agreed by these

authorities that New Zealand during Cainozoic time has passed through an epoch when the glaciers have had a far greater development than at present, for whereas the largest modern glacier of New Zealand, the Tasman Glacier, is 18 miles in length, some of the New Zealand glaciers in Post-Miocene time were upwards of 50 miles long, and in the case of the Wakatipu Glacier, 80 miles long. Captain Hutton has furnished a map showing the relative sizes of the areas formerly glaciated and those at present occupied by glaciers in New Zealand.

The two chief points at present at issue in connection with the glaciation of New Zealand are:—(*a*) As to the date of this glacier epoch; (*b*) as to whether it was due (i) to a general refrigeration of the climate in the Southern Hemisphere, or (ii) to the New Zealand mountains standing several thousand feet higher than they do at present.

Captain Hutton inclines to the last-mentioned view as to the cause of the New Zealand Glacier Epoch. He says (30, p. 211), "I have elsewhere given reasons for concluding that the former great extension of our glaciers was caused by greater elevation of the land during the interval between the Pareora System and the marine beds of the Wanganui System. As these beds are fossiliferous in the North Island only, where there are no traces of former glaciation, it is not possible to get direct proof of this, but in Otago the old Taieri moraine, between Lake Waihola and the sea, which forms low rounded hills between 400 and 500 feet in height, is on the seaward side, covered nearly to the top by marine gravels, which may belong to this sytem or may be younger."

In the Wanganui System, Captain Hutton states (*ibidem*) that from 70 to 90 per cent. of the mollusca and all the brachiopoda are recent. He also states (32, p. 174) that marine fossils in the sandy clays underlying the old Taieri moraine appear to indicate a Miocene Age for these beds, and he suggests that the moraine may be older Pliocene.

He adds that Dr. von Haast found moa bones in morainic deposits belonging to the Wanganui System. He further states

(32, p. 176), "It has been calculated that an elevation of between 3,000 feet and 4,000 feet would be sufficient to expand our glaciers to their former dimensions. That the New Zealand Alps did formerly stand higher than now, we have direct evidence in the deep fiords of South West Otago and Marlborough, which must have been excavated when the land was considerably elevated. The greatest depth recorded in the West Coast Sounds is 1,728 feet in Break Sea Sound; but in many places no bottom was reached with the line used, and we may safely assume that when the valleys were scooped out they stood more than 2,000 feet higher than they do now, and this agrees fairly well with the quite independent estimate that an elevation of 3,000 to 4,000 feet would be sufficient to reproduce all the phenomena." Captain Hutton thus considers the glaciation of New Zealand to have occurred in Pliocene, perhaps older Pliocene time, and to have been due to a former greater elevation of the New Zealand land.

On the other hand, Dr. R. von Lendenfeld is strongly of opinion that the former great extension of the New Zealand glaciers took place in comparatively late geological time, and that it was due to a glacial period synchronous with that which caused the glaciation of Kosciusko (33, p. 808; and 12, p. 52).

In the former paper above referred to, Dr. Lendenfeld states, "The minuteness of the deltas mentioned above (at the heads of the West Coast Sounds, N.Z.) would lead one to suppose that they are of no great age, and comparing them to similar alluvial formations which have been produced in the European Alps in historic time, one must come to the conclusion that the Glacial Period in New Zealand has not been more remote than 2,000 or 3,000 years. This would account also for the extremely fresh appearance of the old moraines and ice scratches." In the latter paper referred to he expresses the opinion that "the state of the preservation of the *roches moutonnées* in the Australian Alps is nothing like so good as in the New Zealand Alps. I am, however, not inclined to ascribe that to a difference in age. I consider it simply as a consequence of the difference in the rocks; there hard metamorphosed slates, here granite." One of us (Mr.

R. Helms) who is familiar with some of the glacial evidences in New Zealand, agrees with Dr. Lendenfeld as to the good state of preservation of the glacial phenomena pointing to a comparatively recent origin, at all events Post-Pliocene. In view of the fact that all the Cainozoic glacial deposits of South America are now considered to be Post-Pliocene, as will presently be explained, the Pliocene, or even older Pliocene Age of the New Zealand glacial evidences may be viewed with great caution, unless it may be admitted that in the Southern Hemisphere, as in the Northern, the glacial epochs of the Ice Age commenced in late Pliocene time, and extended down to at least the close of Pleistocene time.

Kerguelen Island.—H. N. Moseley records evidence of ice action at Betsey Cove and Royal Sound, Kerguelen, close to and even at sea level.

The following statement occurs in the "Challenger" Report (p. 356):—"The interesting feature in relation to these glaciers is that whereas they are to-day confined to the higher valleys of the higher ranges, there are abundant and indisputable evidences that the whole island to and below the sea level was buried under ice at a comparatively recent period. The furrows of glaciers are seen wherever the island has been explored. . . . Every harbour is an ice-cut fiord."

At present, on the south side of the island where the above evidence was obtained, the snow line is between 900 feet and 1,000 feet above sea level.

South America.—Charles Darwin has commented on the greater former extension of the glaciers at Terra del Fuego.*

Also in the same work (pp 242-251) he ably contrasts the climates of Southern South America with those of lands in similar latitudes in the Northern Hemisphere.

The Rev. W. B. Clarke has commented on the analogy between part of Chili and the Australian Alps. He says, "There is a case in South America which very much resembles that of the

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* Naturalist's Voyage Round the World, p. 225. 2nd. edit., 1882.

Muniong (Australian Alps, *authors*), viz., that of Antuco in the southern part of Chili, in lat. 37° 40′, on which snow lies at the height of 7,960 feet, yet even this is far higher in proportion than the snow of Kosciusko" (3, p. 225).

If further observations be omitted (including Baron Nordenskjöld's preliminary report in "Die Geographische Zeitschrift" for 1896) down to within the last few years, we find a summary of his observations in the work noted below, in which he compares the glacial deposits of the Magellan region to the boulder-clay of Europe.*

The same author states in another paper† (p. 408), "Here also (in the neighbourhead of the Gallegos Valley, *authors*) in the neighbourhood of the large depression occupied by the muddy, brackish water of the 'White Lake,' Laguna Blanca, and from there eastwards to the Straits, we find the curious, steep, lofty hills composed of boulder clay, which I observed first in Terra del Fuego, and which are so characteristic of the formerly glaciated territory in this region."

Mr. J. B. Hatcher has also described the Magellan glacial deposits.‡

Referring in a later paper to Mr. Hatcher's observations, Nordenskjöld makes the important statement§ that as regards the age of the Magellan glacial deposits, Hatcher collected some molluscan shells from the Cape Fairweather beds, and Pilsbry has determined these shells to be not older than Pliocene. It is also stated that these shells underlie the oldest glacial deposits of the Magellan Territories.

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* Anales de la Sociedad Cientifica Argentina. Tomo 43-44, 1897, pp. 194-195.

† Geographical Journal. Vol. x. No. 4, October, 1897. A Journey in South-Western Patagonia. By Dr. Otto Nordenskjöld, pp. 401-410.

‡ American Journal of Science. Nov., 1897. Geology of Southern Patagonia. By J. B. Hatcher.

§ American Geologist. Vol. xxi. No. 5, May, 1898. Tertiary and Quarternary Deposits in the Magellan Territories, pp. 300-309. By Otto Nordenskjöld.

Nordenskjöld's conclusions are (*op. cit.* 306-307), that towards the close of the Pliocene Period glaciation set in in the Andean Cordilleras, and enormous quantities of ice collected there giving rise to extensive moraines and a huge development of pampean glacial gravels. Then followed, in his opinion, an inter-glacial period or temporary retreat of the glaciers, with powerful river floods and redistribution of the earlier moraines, "then once more the ice advanced (*op. cit.* p. 307) and extended far down the valleys." He adds (*op. cit.* pp. 307-308), "Many reasons seem to point to the glacial period having lasted down in these regions to, from a geological point of view, quite a recent date, one of the most telling being the great poverty in both the fauna and flora in Terra del Fuego in comparison with Patagonia."

A further account of the glacial deposits of Patagonia is given in a later paper by Hatcher.*

A very important paper bearing on this subject is that by Dr. Francisco P. Moreno in the two numbers of the Geographical Journal.†

Dr. Moreno sums up as follows (*op. cit.* p. 370) :—"In Patagonia an immense ice-sheet extended to the present Atlantic Coast, and further east during the first ice period; while during the second terminal moraines have been generally left as far as 30 miles north and 50 miles south to the east of the present crest of the Cordillera. These ice-sheets, which scooped out the greater part of the longitudinal depressions, and appear to have rapidly retreated to the point where the glaciers now exist, did not succeed in filling with their detritus, in their rapid retirement, the Cordilleran fiords now occupied by deep lakes on the east and by the Pacific channels on the west."

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* Anales de la Sociedad Cientifica Argentina. Tomo xlvii. Primer Semestre de 1899. Buenos Aires, 1899. Estudios Geológicos de la Patagonia. Por J. B. Hatcher.

† Geographical Journal. Vol. xiv. No. 3, Sept., 1899, pp. 241-269, and No. 4, Oct., 1899, pp. 353-378.

With reference to evidences of former greater extension of the Andean glaciers further north, Sir Martin Conway states* (*op. cit.* p. 15), "Evidence is plentiful that in ancient times the glaciers enveloped a large part of these slopes, and reached down many miles further than they do now, depositing the rocks that they carried into the waters of the ancient sea. . . . In the immense pile of débris deep valleys were afterwards cut by the action of water, and into these valleys the glaciers *in a second period of advance* (the italics are ours) protruded their snouts, depositing moraines which can still be traced *in situ* as much as four or even five miles below the present limit of ice. One such glacier cast was carefully examined by me near the foot of Mount Sorata. The terminal moraine now forms the dam of a large lake, 500 feet above the level of whose waters the two lateral moraines can be traced with perfect distinctness."

The evidence, therefore, is overwhelming to show that South America has in Cainozoic time passed through, at all events, two distinct and extensive glaciations, which may range from very late Pliocene into comparatively recent geological time.

V.—SUMMARY.

The evidence obtained in the Australian Alps proves (*a*) that the snowfields of Kosciusko in late Cainozoic time sent small glaciers down the valleys on either side of the Main Dividing Range.

On the western fall, that towards the Murray River, the glaciers at Lake May and Lake Albina descended to levels respectively of about at least as low as 6,600 feet and 6,300 feet. On the eastern fall, towards the Snowy, the glaciers descended to still lower levels. For example, the glacier from Lake Merewether (Blue Lake) in Evidence Valley (Helms) descended to at least as low as 5,800 feet, and probably to 5,500 feet. It would appear, therefore, that the glaciers at Kosciusko descended 500 to 800 feet lower on the eastern fall of the main divide than on the western. There were probably three reasons for this, as already pointed out by one of us (Mr. Helms). (1) The Kosciusko Plateau being constantly exposed to the strong sweep of the W.N.W. anti-trade wind, the chief snow drifts and snowfields gather to leeward of the main dividing ridge, *i.e.*, on its E.S.E. side, the general trend of the ridge being nearly meridional. (2) The western slopes of the main divide are more heated by the sun's rays than are the eastern, so that snow melts off them quicker than off the eastern slopes. (3) The eastern slopes furnish a more favourable lodging for snow than the western, the eastern slopes being the more gradual of the two.

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* Geographical Journal. Vol. xiv. No. 1. Explorations in the Bolivian Andes.

(*b*) The evidence proves that, apart from the consideration of possible much older and much more extensive glaciation, there have been at least two epochs of glaciation at Kosciusko, of which the traces are clear and fresh, viz. (i) an older epoch which may be termed the Hedley Tarn Epoch; and (ii) a new epoch which may be termed the Lake Merewether Epoch. The double series of terminal moraines on either side of the Main Dividing Range obviously points to this conclusion. The height of these moraine embankments, from 80 up to over 200 feet, and their length, between ¼ and ½ mile, prove that the pauses of the ice front at the spots where the moraines became developed must have been of considerable duration.

(*c*) As regards thickness, the evidence shows that the glacier ice must have been about 200 feet and 500 feet thick in the Lake May and Lake Albina valleys on the western fall towards the Murray, while on the eastern fall towards the Snowy it was at least 300 feet thick near the head of the Snowy River, and at least 400 feet thick in Evidence Valley.

(*d*) The longest glacier, that of the Snowy, was perhaps about 3 miles in length.

(*e*) As regards the *age of the glaciation*, it can be estimated at Kosciusko, as far as we could see, only by the amount of subsequent erosion. Such estimates can, of course, be only very approximate.

The data, however, already quoted show that the limit of time may lie somewhere between 3,000 and 10,000 years from the present.

The wonderful freshness of the grooves on some of the "dressed" surfaces and *roches moutonnées*, west of Lake Merewether, Kosciusko, in positions where the rocks could not have been sheltered by moraine material proves that the glaciation was in a geological sense comparatively recent.

We would here like to emphasise the opinion that it is out of the question to refer either the Hedley Tarn glacial epoch or the Lake Merewether glacial epoch of Kosciusko to Tertiary time. We are strongly of opinion that these epochs belong to the Post-Tertiary. If, however, later examination proves that there was a much earlier and far more extensive glaciation which affected the whole of the Kosciusko Plateau and extended even as far down as Lake Coolamatong near Berridale (Plate vi.), (about 2,500 ft. above the sea) as one of us (Mr. Helms) thinks, it is quite possible that this older glaciation may belong to Tertiary time.

(*f*) As regards the position of the snow line at Kosciusko at the maximum extension of ice during the earlier of the two glacial epochs (of the existence of which we have definite proof), the present mean temperature of Kosciusko may be taken to be about 35° Fahr. At the sea-level, in the latitude of Kosciusko, the mean temperature would be about 59° Fahr. At a rate of fall of 1° Fahr. for 345 feet a mean temperature of 32° should be reached at Kosciusko at about 8,200 feet. (The present level at the summit of Kosciusko is 7,328 feet). During therefore the earlier glaciation of the two comparatively recent glacial epochs at Kosciusko, as the ice came down to about 5,500 feet above the sea, the snow line may have been lowered from 8,200 feet to about 5,500 feet (though of course the glaciers of Kosciusko, like many modern glaciers, may have descended below the snow line). This would have meant a lowering of the snow line to the extent of from 2,200 to about 2,700 feet, equal to a lowering of the mean temperature by about 6½° up to about 8°.

being about 2,500 feet above the sea, the lowering of the temperature may have been somewhere about 15° to 16° Fahr. This estimate assumes, of course, that since the glaciation the Kosciusko Plateau altitude has not been appreciably affected by crustal movements or by denudation, and that in other respects meteorological conditions in the past have resembled those of the present

(*g*) As regards collateral evidences, in the Southern Hemisphere, of glaciation in late Cainozoic time, Tasmania shows a lowering of the snow line by about at least 2,500 to 3,000 feet, possibly as much as 4,000 feet, if Mr. T. B. Moore's views as to the age of the moraines near sea-level in the neighbourhood of Macquarie Harbour on West Coast of Tasmania are correct. This might mean a lowering of the temperture by about 12° Fahr., subject, of course, to assumptions similar to those just made in the case of Kosciusko. In New Zealand the evidence adduced shows that the glaciers in the South Island on the east side of the Alps came down to probably at least 3,000 to 4,000 feet below their present terminations. Captain Hutton, however, argues that this did not necessarily imply a general lowering of the snow line to the same amount. He thinks that the extension of the glaciers in New Zealand in late Cainozoic time was due, as already stated, to the South Island at that time standing 3,000 to 4,000 feet higher than it does at present. He states emphatically, "The biological evidence is therefore to the effect that the ocean round New Zealand has not been much colder than at present ever since the Miocene Period."* Even biological evidence, however, is not always reliable, as Charles Darwin has pointed out.†

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* Rept. Aust. Assoc. Adv. Sci. Vol. v. 1893, p. 240.

† Naturalist's Voyage Round the World, 1882, p. 243. "A large Voluta is abundant in Southern Terra del Fuego and the Falkland Islands. At Bahia Blanca, in lat. 39° S., the most abundant shells were three species of Oliva (one of large size), one or two Volutas, and a Terebra. Now these are among the best characterised tropical forms. It is doubtful whether even one small species of Oliva exists on the southern shores of Europe, and there are no species of the two other genera. If a geologist were to find in lat. 39° on the coast of Portugal a bed containing numerous shells belonging to three species of Oliva, to a Voluta and a Terebra, he would probably assert that the climate at the period of their existence must have been tropical; but judging from South America such an inference might be erroneous."

It would be presumption on our part to express any opinion on this important point. At the same time, in view of the evidence lately obtained in South America, Tasmania and Kosciusko, it might be as well for the New Zealand geologists to enquire further into the interpretation of their evidence. In Kerguelen Island the snow line would appear to have been formerly (in late Cainozoic time) at least 1,000 feet lower than at present, and in South America several thousand feet lower, though, as far as we can learn, the exact amount has not yet been calculated. In South America, moreover, there is evidence of at least two distinct epochs of glaciation.

(*h*) In our opinion, even if the case of New Zealand, as being still *sub judice*, be omitted from consideration, the general evidence points to a universal glacial period, of at least two phases or epochs, in the Southern Hemisphere. If these provisional deductions are correct, at least two very important questions suggest themselves for further investigation:—

(1.) Did the glaciation of the Southern Hemisphere lead to definite biological migrations similar to those due to the "Great Ice Age" in the Northern Hemisphere?

(2) If the glaciation of the Southern Hemisphere was synchronous with that of the Northern Hemisphere, as now seems probable, was it due to some great cosmic atmospheric cause, as suggested long ago by Tyndall, such as the variation of the amount of CO_2 in the earth's atmosphere, as lately investigated by Dr. Arrhenius and Mr. Högbom,* and advocated by Professor Chamberlin? †

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* Phil. Mag., April, 1896, pp. 237-276, and Journ. Geology, Vol. vii. Nos. 6, 7 and 8, 1899.

† In connection with this one of us (Prof. David) would suggest that the greater cold at present of the Southern Hemisphere as compared with the Northern may be due to the former having a thinner blanket of air than the latter. The data on this point at present are insufficient, of course, for generalisation, but as far as they go are in favour of the view that atmospheric pressure, and consequently atmospheric thickness, is less in the Southern than in the Northern Hemisphere.

(3) If the glaciation of the Southern Hemisphere was synchronous with that of the Northern, and was accompanied by an appreciable increase in size of the Antarctic ice-sheet, to what extent was sea level lowered in various latitudes through the withdrawal of so much sea water to form the ice-sheets in each hemisphere?

In submitting to this Society the above notes, we are sensible that the information contributed is indeed small in proportion to the wideness and grandeur of the subject.

A vast unknown remains behind full of promise for future investigators. Our observations have, however, we think, finally set at rest a vexed question, and have entirely confirmed the view that the "Roof of Australia," at no very distant date, certainly supported glaciers, and, perhaps, at some earlier date may have even been buried under a "mer de glace."

We desire to express our special obligation to Mr. W. S. Dun for much valuable information as to current literature relating to the glaciation of the Southern Hemisphere in late Cainozoic time. We are also much indebted to Mr. F. B. Guthrie, F.C.S., who accompanied us to Kosciusko, for his constant help and kindly criticism. We also gratefully acknowledge the courteous hospitality of Messrs. P. S. Whelan and P. A. Harding, the officers in charge at Mr. Clement Wragge's Meteorological Observatory at Kosciusko, and the kind help of Mr. G. W. Card, Assoc. R.S.M., F.G.S., in the determination of the rock specimens from Kosciusko, as well as to Professor J. W. Gregory, of Melbourne, for his note on Dr. Arrhenius' theory.

POSTCRIPT (added June 10th, 1901)—Since the above paper was read, Professor J. W. Gregory, of Melbourne, has written to one of us with reference to Dr. Arrhenius' theory as follows:—

"Thinking again over the CO_2 theory of glaciation, I am less inclined to it for the following reasons:—

"(1) Glaciations are not synchronous. There is no evidence of glaciation in Europe or America at the time of the Palæozoic glaciation in Australia and South Africa (Ramsay's Permian breccia is now otherwise explained). Similarly, though there are remains of Pleistocene glaciation in the lands between 40-50° S., there does not appear to have been any such extreme glaciation as affected corresponding latitudes in Europe and America.

"(2) Even adjacent glacial areas are not subject to their maximum glaciation at the same time. Thus N. America has had four main glacial centres, the Cordilleran (Rocky Mountains), the Kewatin (Minnesota, &c.), Labrador, and Greenland. The glaciations at these centres succeeded one another from west to east. The Labradorian glaciation was the last on the mainland; it was succeeded by the growth of the Greenland glaciers, which have perhaps not yet reached their maximum. The evidence certainly points to the fact that the Greenland glaciers have now a greater extension than they have ever had before.

"(3) Schloessing's theory seems probable. According to this the sea is a great reservoir of CO_2 held in the form of bicarbonates; any diminution in the CO_2 content in the atmosphere at once leads to dissociation of the bicarbonates in the sea, which thus automatically regulates the amount of CO_2 in the air. Any such variation as Arrhenius' theory requires would, therefore, be impossible.

"In face of the evidence of the variation of CO_2 in latitude (summarised by Letts & Blake), and of Dittmar's opinion that Schloessing is right, we cannot safely assume an adequate CO_2 variation in the atmosphere. Dittmar's opinion was founded on his own experiment, showing that the dissociation of bicarbonates in sea water corresponds to the CO_2 tension in the air."

With reference to argument (1) mentioned above by Professor Gregory, we think should be considered the very important discovery by Mr. Walter Howchin, F.G.S., of immense glacial boulder beds in the Lower Cambrian of S. Australia, extending over at least 400 miles of latitude, as recorded in his paper just read to the Royal Society of South Australia. This glaciation may perhaps be homotaxial (though not necessarily synchronous)

EXPLANATION OF PLATES III.-X.

Plate iii.

Map showing some of the chief evidences of glacial action, Mount Kosciusko, New South Wales.

Plate iv.

Fig. 1.—Map showing the glacial moraine and striated pavement near the head of the Snowy River, about 1½ miles N. by E. from Mount Kosciusko.

Fig. 2.—Longitudinal Section on line AB.

Fig. 3.—Section on CD across lower end of moraine showing amount of erosion by creek since close of latest glaciation, viz., about 9 feet in depth of moraine and an additional 10 feet of slate rock (phyllite).

Plate v.

Fig. 1.—Longitudinal Section showing terminal moraines and former thickness of glacier ice in Cootapatamba Lake Valley, Mount Kosciusko.

Fig. 2.—Section across Lake Albina Valley showing probable former thickness of glacier ice.

Fig. 3.—Longitudinal Section from Mount Twynam to Snowy River showing terminal moraines and former thickness of glacier ice in the Blue Lake Valley (Evidence Valley).

Plate vi.

Geological Section from Cooma to Mount Kosciusko.

Plate vii.

Roche Moutonnée of gneissic granite showing glacial grooves, the "lee-side" lying to the left. The white vein is aplitic granite parallel to the gneissic folia. About 200 yards S.W. of Lake Merewether, Kosciusko, and looking S.W. Photo by E. F. Pittman.

Plate viii.

Striated boulder of quartzite found on surface of glaciated granite north of Lake Merewether, Kosciusko. Photo by E. F. Pittman.

Plate ix.

Grooved and striated boulder of quartzite found resting on glaciated surface of gneissic granite, about 300 yards S.W. of Lake Merewether, Kosciusko.

Plate x.

Fig. 1.—Grooved pavement of gneissic granite in foreground, with Lake Albina, Kosciusko, in middle distance, with large granite erratics stranded on the slope of the slate hill at the back, toward the left and middle of the picture. Photo by E. F. Pittman.

Fig. 2.—Relic of lateral moraine, near Townsend's Pass, Kosciusko, with Snowy Valley in distance, looking easterly. Photo by T. W. E. David.

APPENDIX OF CHIEF WORKS CONSULTED.

i.—Cainozoic Glaciation in Southern Hemisphere.

A. *Australia in general.*

1.—Tenison-Woods (Rev. J. E.)—On the Glacial Period in Australia. *Trans. & Proc. R. Soc. Victoria*, viii., 1867, pp. 43-47.

2.———— Physical Structure and Geology of Australia. *Proc. Linn. Soc. N.S. Wales*, vii., 1882, pp. 371-389.

B. *New South Wales.*

3.—Clarke (Rev. W. B.)—Researches in the Southern Gold Fields of New South Wales. Sydney, 1860. See especially pp. 225, 226, 228, and 230.

4.—Curran (Rev. J. M.)—Exhibit of photographs and rock-specimens illustrative of the physiography and geology of the Mt. Kosciusko Plateau, especially in relation to the so-called evidences of Glaciation; with Remarks thereon. *Proc. Linn. Soc. N.S. Wales*, xxi. Pt. 4, p. 819, Nov. 1896 [May, 1897].

5.————On the Evidence (so-called) of Glacier Action on Mount Kosciusko Plateau. *Op. cit.* xxii. Pt. 4, pp. 796-809, pls. xxxvii.-xxxix., Nov. 1897 [June, 1898].

6.—Helms (R.)—Exhibit of Glacier-polished Slab from Moraine at base of Mt. Twynan, Snowy Mts., Australian Alps. *Proc. Linn Soc. N.S. Wales*, (2), viii. Pt. 2, p. 328, September, 1893 [March, 1894].

7.————On the recently observed Evidences of an extensive Glacier Action at Mount Kosciusko Plateau. *Op. cit.* (2), viii., Pt. 3, pp. 349-364, pl. xviii., October, 1893 [April, 1894].

8.————The Australian Alps, or Snowy Mountains. *Journ. R. Geog. Soc. Aust, Sydney*, iv. No. 4, pp. 75-96, Oct.-Dec., 1896. See especially pp. 78 and 83.

9.—Jaquet (J. B.)—Geological Notes upon a Trip to Mount Kosciusko, New South Wales. *Records Geol. Surv. N.S. Wales*, v., Pt. 3, 1897, pp. 113-117.

10.—Kitson (A. E.) and Thorn (W.)—Contributions to the Geology of Mount Kosciusko and the Indi-Monaro Track. *Report Aust. Assoc. Adv. Sc.*, vii., Sydney, 1898 [1899], pp. 367-370.

11.—Lendenfeld (R. von)—Report on the Results of his recent Examination of the Central Part of the Australian Alps, pp. 1-16, pls. i.-vi. Govt. Printer, Sydney, Jan. 21st, 1885.

12.————The Glacial Period in Australia. *Proc. Linn. Soc. N.S. Wales*, x. Pt. 1, pp. 44-53, pls. vii.-viii., Jan., 1885 [June].

13.———— ———— *Petermann's Mittheilungen*, 1887, *Ergänzungsheft*, No. 87.

C. *Victoria.*

14.—Griffiths (G. S.)—On the Evidences of a Glacial Epoch in Victoria during Post-Miocene Times. *Trans. & Proc. R. Soc. Victoria*, xxi., 1884 [1885], pp. 1-28.

15.—Howitt (A. W.)—The Physical Geography and Geology of North Gippsland, Victoria. *Q.J.G.S.*, xxxv., 1879, pp. 1-41. See especially p. 35.

16.———— Notes on Lake Karng. *Reports and Statistics of the Mining Department, Victoria, for Quarter ended 30th September, 1891*, pp. 26-30, with plates.

17.—Kitson (A. E.)—Geological Notes on the Gehi and Indi Rivers and Monaro Gap, Mount Kosciusko, N.S.W. *Proc. R. Soc. Victoria*, n.s. ix., 1897, pp. 22-28.

18.—Stirling (J.)—The Physical Features of the Australian Alps. *Trans. & Proc. R. Soc. Victoria*, xviii., 1881, [1882], pp. 98-110, with two plates.

19.—Stirling (J.)—Notes on the Meteorology of the Australian Alps. *Op. cit.* xxi., 1884, [1885], pp. 144-145.

20.————Notes on Evidences of Glaciation in the Australian Alps. *Op. cit.*, xxii., 1885 [1886], pp. 20-34.

21.————Physiography of the Tambo Valley. *Trans. Geol. Soc. Australasia*, Vol. i. Pt. 2, Melbourne, 1887. See especially p. 49.

D. *Tasmania.*

22.—Dunn (E. J.)—Glaciation of the Western Highlands of Tasmania. *Proc. R. Soc. Victoria*, n.s. vi., 1893, [1894], pl. viii. See especially pp. 134-135, 137-138.

23.—Johnston (R. M.)—Geology of Tasmania. By authority. Hobart, 1888. See especially pp. 254-257, and 296.

24.————The Glacier Epoch of Australasia. *Papers & Proc. R. Soc. Tasmania for 1893*, pp. 73-134, [June, 1894].

25.————Notes on the Geology of Lake St. Clair and its immediate Neighbourhood, together with Observations regarding the probable Origin of our numerous Tasmanian Lakes and Tarns. *Op. cit. for 1893*, pp. 135-146, [1894].

26.—Montgomery (A.)—Glacial Action in Tasmania. *Op. cit. for 1893*, [1894], pp. 159-169. See especially pp. 162 and 164.

27.—Moore (T. B.)—Discovery of Glaciation in the Vicinity of Mount Tyndall, in Tasmania, with Supplementary Notes. *Op. cit. for 1893*, pp. 147-149, [1894].

28.————Notes on further Proofs of Glaciation at lower Levels. *Op. cit. for 1894-95*, [August, 1896], pp. 73-77.

29.—Officer (G.), Balfour (L.), and Hogg (E. G.)—Geological Notes on the country between Strahan and Lake St. Clair, Tasmania. *Proc. R. Soc. Victoria*, n.s. vii., 1894 [1895]. See especially pp. 119, 124, 125, and 127-130.

E. *New Zealand.*

30.—Hutton (F. W.)—Sketch of the Geology of New Zealand. *Q.J.G.S.*, xli., Pt. 2, May, 1885. See especially pp. 211 and 213.

31.————Glacier Action in New Zealand. *Report Aust. Assoc. Adv. Sc.*, v., Adelaide, 1893 [1894], pp. 232-240.

32.————The Geological History of New Zealand. *Trans. & Proc. N.Z. Inst.*, xxxii., 1899 [1900], pp. 159-183. See especially pp. 174 and 176.

33.—Lendenfeld (R. von)—The Time of the Glacial Period in New Zealand. *Proc. Linn. Soc. N.S. Wales*, ix., 1884 [1885], pp. 806-808.

F. *Kerguelen.*

34.—Moseley (H. N.)—Notes by a Naturalist on the Challenger. London, 1879, pp. 197-199.

35.————Report of the Challenger Expedition. Narrative, i., Pt. i., pp. 348, 349, 374.

G. *South America.*

36.—Conway (Sir M.)—Explorations in the Bolivian Andes. *Geogr. Journ.* xiv., No. 1, July, 1899. See especially pp. 14-15.

37.—Darwin (C.)—Naturalist's Voyage round the World. 2nd ed. London, 1882. See especially pp. 225 and 242-251.

38.—Hatcher (J. B.)—Geology of Southern Patagonia. *Amer. Journ. Sci.*, Vol. iv., 1897, pp. 246-248, 327-354.

39.————Estudios Geológicos de la Patagonia. *An. Soc. Cient. Argentina.* Tomo xlvii., Primer Semestre de 1899, pp. 77-79.

40.—Moreno (F. P.)—Explorations in Patagonia. *Geogr. Journ.*, xiv., No. 3, Sept., 1899, pp. 241-269; No. 4, Oct., 1899, pp. 353-372.

41.—Nordenskjold (O.)—Tierra de Fuego. *Geograph. Zeitsch.*, 1896.

42.————Algunos datos sobre la Naturaleza de la Région Majellánica. *An. Soc. Cient. Argentina.* Tomo xliii.-xliv., 1897, pp. 190-197.

43.————A Journey in South Western Patagonia. *Geogr. Journ.*, x., No. 4, Oct., 1897, pp. 401-410.

44.————Tertiary and Quarternary Deposits in the Magellan Territories. *Amer. Geol.*, xxi., No. 5, May, 1898, pp. 300-309.

ii.—Miscellaneous.

45.—Arrhenius and Hoegbom.—On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground. *Phil. Mag.*, April, 1896, pp. 237-276.

46.—Brittlebank (C. C.)—The Rate of Erosion of some River Valleys. *Geol. Mag.* No. 433, n.s. Dec. iv., Vol. vii., July, 1900, pp. 320-322. (A paper read at the Meeting of the Aust. Assoc. Adv. Sc. in Melbourne in January, 1900).

47.—Carne (J. E.)—Annual Report, Dept. Mines and Agric. N.S. Wales for 1897, pp. 150-155.

48.—Chamberlin (Prof.)—Papers on the subjects treated of in No. 45. in relation to Glacial Epochs. *Journ. of Geology*, vii., Nos. 6, 7 and 8.

49.—Hogben (G.)—*Report Aust. Assoc. Adv. Sc.*, iv., Hobart, 1892 [1893], pp. 294-295.

50.—Hoegbom (A. G.)—*Svensk Kemisk Tidskrift*, Bd. vi., p. 169 (1894).

51.—Howitt (A. W.)—Notes on Samples of Rocks collected by A. E. Kitson and W. Thorn. *Report Aust. Assoc. Adv. Sc*, vii., Sydney, 1898 [1899], pp. 370-374.

52.—Luigi (De Marchi)—Le Cause dell 'Era Glaciale, premiato dal R. Instituto Lombardo, Pavia, 1895.

53.—Strzelecki (P.)—Report on the Geographical Mineralogy of New South Wales. Appendix C to Governor Sir George Gipps's Despatch dated Sydney, 28th Sept., 1840, p. 12. Abstract in Tasm. Journ. Sc. i., 1842, p. 67.

NOTES AND EXHIBITS.

Mr. Maiden exhibited specimens of the Acacia described in his paper.

Messrs. David, Helms and Pittman exhibited a series of lantern views, photographs, coloured diagrams, glaciated boulders, rock specimens, and rock-sections under microscopes, illustrating in detail the geology of the Kosciusko plateau.

WEDNESDAY, APRIL 24TH, 1901.

The Ordinary Monthly Meeting of the Society was held at the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, April 24th, 1901.

Mr. J. H. Maiden, F.L.S., &c., President, in the Chair.

Messrs. W. H. ROWSELL, O'Connell Street, Sydney; JOHN N. GRIFFITHS, Woollahra; and JOHN L. ADAMS, North Sydney, were elected Members of the Society.

The President announced that under the provisions of Rule xxv., the Council had elected Dr. J. C. Cox, F.L.S., Professor David, B.A., F.R.S., F.G.S., Mr. Henry Deane, M.A., F.L.S., &c., and the Hon. James Norton, LL.D., M.L.C., to be VICE-PRESIDENTS; and Mr. Prosper N. Trebeck, J.P., to be HON. TREASURER for the current year.

Also, that the Council had elected Monsieur A. RAFFRAY, Consulât Général de France, Cape Town, a Corresponding Member of the Society.

DONATIONS.

Department of Agriculture, Brisbane—Queensland Agricultural Journal. Vol. viii. Part 4 (April, 1901). *From the Hon. the Secretary for Agriculture.*

Australian Museum, Sydney—Records. Vol. iv. No. 1 (March, 1901). *From the Trustees.*

Department of Mines and Agriculture, Sydney: Geological Survey—Mineral Resources of New South Wales. By E. F. Pittman (1901): Agricultural Gazette of New South Wales. Vol. xii. Part 4 (April, 1901). *From the Hon. the Minister for Mines and Agriculture.*

Royal Anthropological Society of Australasia, Sydney—Science of Man. Vol. iv. n.s. No. 2 (March, 1901). *From the Society.*

The Surveyor, Sydney. Vol. xiv. No. 3 (March, 1901). *From the Editor.*

Australasian Institute of Mining Engineers, Melbourne—Transactions. Vol. vii. (1901). *From the Institute.*

Australasian Journal of Pharmacy, Melbourne. Vol. xvi. No. 184 (April, 1901). *From the Editor.*

Department of Agriculture, Victoria—Handbook of the Destructive Insects of Victoria. Part iii. (1900). By C. French, F.L.S., F.R.H.S., Government Entomologist. *From the Author.*

Field Naturalists' Club of Victoria—Victorian Naturalist. Vol. xvii. No. 12 (April, 1901). *From the Club.*

University of Melbourne — Annual Examination Papers, October-December, 1900. *From the University.*

Zoological and Acclimatisation Society of Victoria, Melbourne—Thirty-seventh Annual Report, for the year 1900. *From the Society.*

Department of Agriculture, Perth, W.A.—Journal. Vol. iii. Part 3 (1901). *From the Secretary.*

American Naturalist, Cambridge. Vol. xxxv. Nos. 410-411 (Feb.-March, 1901). *From the Editor.*

Connecticut Academy of Arts and Sciences, New Haven—Transactions. Vol. x. Part 2 (1900). *From the Academy.*

U.S. Department of Agriculture, Washington: *Division of Agrostology*—Circular, No. 29: *Division of Biological Survey*—North American Fauna, No. 16 (1899): *Division of Vegetable Physiology and Pathology*—Bulletin. No. 26 (1901). *From the Secretary for Agriculture.*

Museo Nacional de Montevideo—Anales. Tomo ii. Fasc. xvii. (1901); Tomo iii. Fasc. xviii. (1900). *From the Museum.*

Manchester Literary and Philosophical Society—Memoirs and Proceedings. Vol. xlv. Part 1 (1900-1901). *From the Society.*

Royal Botanic Gardens, Kew—Hooker's Icones Plantarum. Fourth Series. Vol. vii. Part 4 (Feb., 1901). *From the Bentham Trustees.*

Royal Microscopical Society, London—Journal, 1901. Part 1 (February). *From the Society.*

Royal Society, London—Proceedings. Vol. lxviii. No. 442 (1901). *From the Society.*

Seven Conchological Separates (1899-00). By E. A. Smith, F.Z.S. *From the Author.*

Zoological Society of London—Abstract, Feb. 3rd and 19th, March 5th, 1901: Transactions. Vol. xv. Part 5 (Dec., 1900). *From the Society.*

Government Museum, Madras—Anthropology: Bulletin. Vol. iv. No. 1 (1901). *From the Museum.*

Indian Museum, Calcutta—Annual Report, 1899-1900. *From the Trustees.*

Perak Government Gazette, Taiping. Vol. xiv. Nos. 11-13 (March, 1901). *From the Government Secretary.*

South African Museum, Cape Town—Annals. Vol. ii. Part v. (Jan., 1901). *From the Museum.*

Naturforschende Gesellschaft in Basel—Verhandlungen. Band xiii. Heft i. (1901). *From the Society.*

Zoologischer Anzeiger, Leipzig. xxiv. Band Nos. 637-638 (Feb.-March, 1901). *From the Editor.*

Société Royale de Géographie d'Anvers—Bulletin. Tome xxiv., 1er Fasc. (1900). *From the Society.*

Société Géologique de Belgique, Liége—Annales. Tome xxv. *bis* (Liber Memorialis) 1^{e} Livraison; T. xxvi., Planches 1-3 (1900): T. xxvii. 4^{e} Livr. (1901): T. xxviii. 1^{e} Livr. (1901). *From the Society.*

Société Royale Linnéenne de Bruxelles—Bulletin. 26^{e} Année. No. 4. (Feb., 1901). *From the Society.*

Comité Géologique, St. Pétersbourg — Bulletins. Vol. xix. Nos. 1-6 (1900); Mémoires. Vol. xiii. No. 3 (1900). *From the Committee.*

NOTES FROM THE BOTANIC GARDENS, SYDNEY.

No. 7.

By J. H. Maiden and E. Betche.

MALVACEÆ.

Plagianthus pulchellus, A. Gray, var. **tomentosus**, Hook.

Queanbeyan (W. Farrer, October, 1897); Jenolan Caves (W. F. Blakely, October, 1899); Tumberumba (W. Forsyth, November, 1900).

The tomentose variety of *Plagianthus pulchellus* is common in Tasmania and Victoria, but has not been previously recorded from New South Wales.

TILIACEÆ.

Elæocarpus grandis, F.v.M.

Way Way Creek, Nambucca River (G. R. Brown, December, 1900). The most southern locality recorded.

RUTACEÆ.

Zieria Smithii, Andr., var. **Fraseri**, F.v.M. (unpublished).

Wallangarra (E. Betche, December, 1891); Mograni Mountain, near Gloucester (J. H. Maiden, September, 1897).

A shrub several feet high, with tomentose young branches. Leaflets lanceolate, with recurved margins, about ¾ inch long, glabrous above, white-tomentose underneath. A very distinct variety, apparently connecting *Z. Smithii* with *Z. cytisoides*, Sm.

Named by Mueller in the Melbourne Herbarium from specimens from "New England" without date and collector's name.

ZIERIA LÆVIGATA, Sm., var. LAXIFLORA, Benth.

Byron Bay (W. Forsyth, September, 1900). New for New South Wales.

The Byron Bay specimens agree completely with Queensland specimens from Stradbroke Island, one of the original habitats of this variety.

ZIERIA GRANULATA, C. Moore, var. ADENODONTA, F.v.M. (unpublished).

"Highest mountain on the Tweed River" (Carron, no date, about 1865); Mount Warning (W. Forsyth, September, 1900).

Leaflets lanceolate, about ¾ inch long, apparently somewhat dentate by the large glandular tubercules on the margins. The white underside of the leaflets, which is almost concealed in the southern species, is very conspicuous in this variety. Named by Mueller in the Melbourne Herbarium from Carron's specimens.

ASTEROLASIA CORREIFOLIA, Benth., var. MUELLERI, F.v.M. (*A. Muelleri*, Benth.).

Lobb's Hole (W. Forsyth, November, 1900).

Distinguished from the common New South Wales form by the sulphur-yellow flowers and the stellate-hairy upperside of the leaves. It is the common form in Victoria, but has not been previously recorded from New South Wales.

GEIJERA SALICIFOLIA, Schott, var. ANGUSTIFOLIA, var.nov.

Tia Falls, New England (W. Forsyth, October, 1900).

Leaves not above 7 to 8 lines broad with a length of 2½ to nearly 3 inches. Bentham says, in a footnote in the *Flora Australiensis*, "Schott's figure (Schott, *Fragm. Bot.* t. 4) represents a remarkably narrow-leaved form, which I have only seen in Brown's specimens, and in those from Warwick and from Rockhampton"

(Queensland localities). Our Tia specimens agree exactly with the narrow-leaved Warwick specimens in the Melbourne Herbarium.

RHAMNACEÆ.

POMADERRIS PHYLICIFOLIA, Lodd.

Warrumbungle Range (W. Forsyth, October, 1899). Most northerly locality recorded.

SAPINDACEÆ.

NEPHELIUM FORSYTHII, sp.nov.

A tree attaining 25 feet in height, with a stem 14 inches in diameter, but generally shrubby and 10 to about 15 feet high; glabrous except the young shoots. Leaves abruptly pinnate; leaflets shortly pedicellate, 2 rarely 4, opposite, usually oval-oblong and obtuse, 2½ to 3½ inches long, quite entire, coriaceous, reticulate on both sides, rather pale green but shining above, paler and opaque underneath. Flowers in axillary or lateral sometimes apparently terminal panicles, little branched, not (or scarcely) exceeding the leaves when in flower, the single flowers on short pedicels, often in clusters of 2 or 3. Calyx 5-toothed. Petals absent. Stamens 7 or 6, inserted round the ovary within the disk; anthers oblong, glabrous, as long or longer than the short filament. Ovarium sessile, 2- or rarely 3-celled, 2- or rarely 3-edged, slightly hairy; style very short or the stigmatic lobes almost sessile. The calyx, stamens, pedicels, and more or less the rachis of the panicle are of a dark violet colour, giving the whole inflorescence a blackish appearance in the dried specimens; the thick annular disk is yellow. Carpels usually 2 (apparently only exceptionally 3), flattened, quite connate, horizontally spreading, the whole fruit flat-topped, with a short central stigmatic cone, often rather above ¾ of an inch broad, about 4 lines high and 1 to 2 lines thick, very shortly or scarcely stipitate and apparently quite indehiscent, glabrous inside. Seeds flattened, partially enclosed in the arillus; embryo curved.

Tia Cañon (J. H. Maiden, November, 1897, and J. Kretschmann, December, 1898); Tia and Apsley Cañon (W. Forsyth, October, 1900).

Allied to *N. subdentatum*, F.v.M., from which it is chiefly distinguished by the entire leaflets, inflorescence and the shape of the fruit. It seems to be confined to the deep cañons of the Walcha district in the New England tableland, where it forms a scrub extending from nearly the top to the bottom on many parts of the steep sides of the Tia Cañon.

LEGUMINOSÆ.

OXYLOBIUM TRILOBATUM, Benth., var. ILICIFOLIUM, var. nov.

Mount Warning (Tweed River) at a height of 3,200 feet (W. Forsyth, September, 1900).

Leaves ovate, with rather numerous pungent teeth.

This form is included in the description of *O. trilobatum* in the *Flora Australiensis*, but the holly-like leaves give it such a different appearance from the typical form with trilobate leaves, that we propose to separate it as a variety. There certainly appear to be forms connecting this handsome variety with the typical species.

PULTENÆA MUCRONATA, F.v.M.

Blackheath, Blue Mountains (A. A. Hamilton, October, 1900).

The most northern locality recorded.

PULTENÆA PLUMOSA, Sieb.

Apsley Falls, New England (W. Forsyth, October, 1900).

The most northern locality recorded. Previously only known form Port Jackson and the Blue Mountains, extending as far west as Wallerawang.

MYRTACEÆ.

THRYPTOMENE (MICROMYRTUS) HEXAMERA, sp. nov.

Road from Bourke to Ford's Bridge, Warrego River (E. Betche, September, 1885); road from Bourke to Barringun (W. S. Campbell, September, 1893); road from Bourke to Goombalie, Warrego River (E. Betche, September, 1900).

An erect heath-like shrub, attaining about 10 feet in height, with slender branches. Leaves obovate, under 1 line long, thick, slightly concave and somewhat keeled, with few large dark oildots, decussate on the ultimate branchlets, and almost concealing the white bark of the young twigs. Flowers solitary, pedicellate in the axils of the upper leaves, the pedicels about as long as the leaves. Bracteoles scarious, of the size and shape of the leaves, but very deciduous, and seen only on a few young buds. Calyx-tube turbinate, scarcely 1 line long, irregularly 10-ribbed, the ribs proceeding from the centre of the sepals and petals, but often coalescing. Sepals small, semi-orbicular, scarious. Petals nearly orbicular, white, above twice as large as the sepals, both with somewhat jagged edges, and almost constantly 6 in number in all flowers examined. Stamens twice as many as the petals, inserted on the margin of the prominent disk, half of them opposite the petals, all on short, rather thick filaments incurved towards the small style. Anthers with almost globular cells opening in parallel slits, the connective tipped with a globular gland. Ovules 8 to 10, attached near the summit of a filiform placenta extending from the base of the ovary to the summit. Ripe seeds not seen.

Thryptomene hexamera belongs to Bentham's genus *Micromyrtus*, united by Mueller with *Thryptomene*. The two genera are so closely allied, and so much alike in habit and general appearance, that we propose to follow Mueller in reducing *Micromyrtus* to a section of *Thryptomene*, in spite of the difference in the placentation, on which Bentham chiefly bases his genus. It is more nearly allied to the West Australian species of *Micromyrtus* than to the two New South Wales species, *M. microphylla* and *M. minutiflora*, and differs from all in the numerous ovules, in the abnormal number of petals, which we found almost constant in the specimens from all the localities, and in many other respects. Its range seems to be north and north-west of Bourke, between the Darling and Warrego Rivers, from whence it may extend into Queensland. Its western limit is also still unknown to us; we can only say we have not seen it west of the Warrego River, in spite of an extended journey in the Paroo River district last year.

For excellent sections of fruit and flower we are indebted to Miss S. Hynes, B.A.

UMBELLIFERÆ.

ACTINOTUS HELIANTHI, Labill.

Portion 15, Parish of Pringle, County Inglis, 40 miles from Walcha (J. F. Campbell, 1901); sandstone hills, near Wallangarra (E. Betche, December, 1891)—two isolated New England localities for the common Flannel-flower.

RUBIACEÆ.

KNOXIA CORYMBOSA, Willd.

Mullumbimby (W. Bäuerlen, January, 1897). New for New South Wales.

Previously recorded from Queensland, extending to tropical Asia. The flowers are considerably smaller than in an Asiatic specimen figured in Wight's *Illustr. of Indian Botany*, t. 128.

Specimens kindly supplied by Mr. R. T. Baker.

COMPOSITÆ.

CALOTIS INERMIS, sp. nov.

A low herb, apparently annual, branching from the base with ascending striate stems, hispid all over with white somewhat scaly hairs. Leaves cuneate, with a long narrow base, sessile, half stem-clasping and sometimes with a slightly dilated base, usually ½ to 1 inch long and 3 to 5 lines broad at the top, 5- to 10-toothed towards the top, the uppermost leaves more linear-cuneate and with fewer teeth. Flower-heads large, on long slender petioles. Involucral bracts lanceolate, very acute or acuminate, brown, somewhat scarious, acute point. Ray-florets purple, the rays spreading in the largest head to fully 1 inch in diameter; disc-florets yellow. Achenes of the ray-florets obovate, short, flat, striate, hirsute with short hairs. Pappus consisting of about 18 to 20 long soft setæ, in the dried specimens often nearly as long as the crumpled rays, plumose from top to base with horizontally spreading hairs. Achenes of the disc-florets abortive, with a pappus like that of the ray-flowers, but shorter; ripe achenes not seen.

Urisino, 20 miles west of Wanaaring on the Paroo River (E. Betche, September, 1900).

This very handsome new species is, from the point of view of the wool-grower, favourably distinguished by its innoxious fruiting-heads from all the other burr-plants composing the genus *Calotis*. The long soft setæ of the pappus are quite unique in the genus, and may perhaps, by some, be regarded as sufficient reason to establish a new genus, but as its habit and all other characters agree well with *Calotis*, we prefer to consider it as an aberrant species of that genus. It cannot be placed in any of Bentham's four sections of *Calotis*, but forms a fifth section by itself.

GOODENIACEÆ.

VELLEIA SPATHULATA, R.Br.

National Park, near Sydney (A. A. Hamilton, March, 1900); Narrabeen Swamps (A. A. Hamilton, April, 1900).

Hitherto not recorded further south than Newcastle.

EPACRIDEÆ.

EPACRIS ROBUSTA, Benth.

Jenolan Caves (W. F. Blakely, September, 1900).

A rare plant, previously recorded only from the summit of White Peak Mountain, at the head of the Genoa River.

The size and colour of the flower seem to differ greatly in this species. The flowers of the Genoa River specimens are described as "white, with a slight yellowish tinge," and the corolla-tube does not exceed the calyx; while the Jenolan Caves specimens are pinkish, the pink colour extending down to the bracts and sepals, and the corolla-tube is rather above 3 lines long, considerably exceeding the calyx. It is chiefly distinguished from *E. crassifolia*, R.Br., in habit; *E. crassifolia* is a small trailing shrub, growing in crevices of moist rocks, while *E. robusta* is an erect, robust shrub of 3 to 4 feet, growing on dry rocky summits. *E. crassifolia* varies also much in the length of the corolla-tube, and some of the forms collected in drier localities show a tendency to upright growth, and seem to merge into *E. robusta*.

EPACRIS CALVERTIANA, F.v.M., var. VERSICOLOR, var.nov.

Belmore Falls, near Moss Vale (W. Forsyth, September 30, 1900).

A very handsome variety, with flowers resembling those of *E. longiflora*, Cav., in colour and approaching them in size. Corolla rather above ¾ inch long, with a red tube and white lobes. Upper leaves distinctly ciliate.

EPACRIS PURPURASCENS, R.Br., var. ONOSMÆFLORA, var.nov.

Kanangara Walls, near Jenolan Caves (W. F. Blakely, October, 1899, and September, 1900); between Mt. Victoria and Mt. York (H. Hammond Maiden, November, 1899); Blackheath (A. A. Hamilton, October, 1900).

Chiefly differing from the common forms of *E. purpurascens* in the inflorescence being confined to the upper part of the branches, never extending in our specimens as far down the branches as in the purpurascent form, in the flowers being white and with a longer corolla-tube, and in the hypogynous glands, which are more or less united in a complete undulate ring. The leaves vary from rather narrow to broad ovate-lanceolate. The broad-leaved specimens have entirely the habit of the common *E. purpurascens*, with the same spreading, upwards recurved, pungent-pointed leaves, embracing the stem in the lower part and almost concealing it, while the more narrow-leaved specimens leave the stem exposed. The corolla-tube is about 3 lines long and rather longer in proportion to the corolla-lobes and to the calyx than usual in *E. purpuascens*, but the exserted glabrous style and the half-exserted stamens are entirely as in this species. We refer this plant with some doubt to *E. purpurascens*, but though it differs considerably from this species, and the difference seems to be constant, at least in the flowers, the points seem to be scarcely enough to justify its establishment as a new species. We do not doubt that it is the *E. onosmæflora*, A. Cunn., in Field's *New South Wales*, p. 340, figured in *Bot. Mag.* t. 3,168. "Discovered by Allan Cunningham in October, 1822, in peaty bogs at Blackheath, on the Blue Mountains of New Holland," so that Mr. Hamilton's specimens are from the original locality.

SAPOTACEÆ.

NIEMEYERA (CHRYSOPHYLLUM) PRUNIFERA, F.v.M.

Warrall Creek, Hastings River district (G. R. Brown, August, 1900).

The most southern locality recorded.

EBENACEÆ.

DIOSPYROS MABACEA, F.v.M. (*Cargillia mabacea*, F.v.M.).

Murwillumbah (R. A. Campbell, March, 1901).

The fruits have not been previously described.

Fruit a scarlet globular berry about 1¼ inches in diameter in the largest specimens seen, 4-celled, with 2 seeds in each cell, but generally only one perfect. Seeds more or less triangular, with flat sides, the testa brown, shining, neatly sculptured.

AMARANTACEÆ.

PTILOTUS LEUCOCOMA, F.v.M. (*Trichinium leucocoma*, Moq.)

Red clay country, west of the Darling River (D. W. F. Hatton, May, 1900); Urisino, Paroo River District (E. Betche, September, 1900). New for New South Wales. Previously only recorded from the Eremian region of South Australia. The Inspector of Stock in Bourke, Mr. Hatton, who seems to be a reliable observer, informs us that he has met with the plant in the south within 100 miles of Bourke, while in the north the Culgoa River seems to be its eastern limit.

The New South Wales specimens form dense patches exceeding two feet in diameter in old plants, and are, according to Mr. Hatton, by no means uncommon in the sterile red clay country of the far north-west. They differ from the description in Bentham's *Flora Australiensis* and from the fragmentary South Australian specimen we have seen, in the size of the spike, which is quite cylindrical and above 1 inch long, and in the pinkish colour of the sepals.

PROTEACEÆ.

Hakea Fraseri, R.Br.

Tia Falls, New England (W. Forsyth, October, 1900).

A shrub about 10 feet high. Fruit nearly straight, smooth, about 1¼ inches long and about 5 lines broad.

As the fruit of this apparently very local handsome shrub has not been hithorto known, we have given the above description from a few old capsules (without seeds) collected by Mr. Forsyth.

JUNCACEÆ.

Juncus cæspititius, E. Mey.

Centennial Park, Sydney (E. Cheel, December, 1900).

New for the Port Jackson district. Previously only recorded in this colony from the southern districts.

CYPERACEÆ.

Elynanthus capillaceus, Benth.

National Park, near Sydney (J. L. Boorman, December, 1900).

Most northern locality recorded. First recorded as a New South Wales plant from Twofold Bay in *Proc. R. Soc. N.S. Wales.* Vol. xxvii. p. 84, 1893.

GRAMINEÆ.

PANICUM GILESII, Benth.

Olive Downs, Tibooburra (J. W. Johnson, May, 1900). New for New South Wales.

A Central Australian species previously recorded from S. Australia, Queensland, and W. Australia.

CHLORIS BARBATA, Sw., var. DECORA, Benth.

Olive Downs, Tibooburra (J. W. Johnson, May, 1900). New for New South Wales. Previously only recorded from the Eremian region of South Australia and Western Queensland, but now added to the flora of New South Wales.

ERAGROSTIS NIGRA, Nees.

Hill Top (J. H. Maiden, January, 1896); Barber's Creek (J. H. Maiden, December, 1897, and January, 1898); Balmoral (Wm. Corner, May, 1900). (The three localities mentioned are stations on the Great Southern Railway).

The most southern localities. Previously only recorded in this colony from the New England Tableland.

ERAGROSTIS LEPTOCARPA, Benth.

Olive Downs, Tibooburra (J. W. Johnson, May, 1900). New for New South Wales.

A Central Australian species previously recorded from S. Australia, Queensland and W. Australia.

The very narrow grain, to which the specific name alludes, is very characteristic of this species.

FESTUCA DURIUSCULA, Linn.

Moona Plains, in the Walcha district (A. R. Crawford, July, 1900). The most northern locality recorded.

A tall form with large spikelets and rather long awns (approaching var. *aristata* from Victoria and S. Australia). The panicle is rather broad and often about 10 inches long.

LYCOPODIACEÆ.

LYCOPODIUM CERNUUM, Linn.

Mullumbimby (W. Bäuerlen, September, 1894); Tumbulgum (W. Bäuerlen, April, 1898); near Murwillumbah (W. Forsyth, September, 1900). New for New South Wales.

Apparently common in the brush-forests between the Brunswick and Tweed Rivers, but not previously recorded as a New South Wales plant. First received from the then Curator of the Technological Museum in 1895.

NOTES ON THE CAVES OF FIJI, WITH SPECIAL REFERENCE TO LAU.

By B. Sawyer, B.E., and E. C. Andrews, B.A.

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1. *Singatoké River.* 2. *Mata-ni-Vatu.*

C.—Caves of Lau.—Description of Mango .. ... p. 95

The Caves.—1. *Mango ;* 2. *Thithia ;* 3. *Lakemba ;* 4. *Nghillinghillah ;* 5. *Bai Vatu ;* 6. *Vatu Leile.*

D.—The Crevasses in the Submarine Reef Platforms ... ... p. 99

E.—1. *Brief Description of Cave Formation ;* 2. *Origin of Viti Levu Caves (Evidence) ;* 3. *Origin of Lau Caves (Evidence).*

F.—Description of Access to Caves :.. ... ... p. 104

G.—Caves as Dwellings and Fortresses ... ... p. 105

A.—Introduction.

During a coral reef expedition undertaken in 1898 for Prof. A. Agassiz, of Harvard College, U.S.A., it was our fortune to examine a number of caves existing in the various raised coral atolls of the Fiji and Tonga groups.

These present many points of interest to geologist and naturalist alike. To the latter the scarlet prawns of the Vatu Leile caverns, the unique shell fish from Wangava, and other animal curiosities would furnish special attractions.

For the benefit of anyone wishing to further examine these caverns, we may mention the necessity of carrying ropes and magnesium wire.

For the purposes of cave photography, we would recommend a camera capable of being focussed within very short distances. We lost many pictures through inability to focus our camera on any object at distances less than seven feet.

The camera should also be fitted into a tin case provided with a closely fitting cover. The cover should be as deep as the case. This provision would ensure against accident in the case of an upset when crossing the numerous streams and lagoons, or when caught out in any of the heavy tropical rains.

Most plates are speedily ruined in the moist atmosphere of the tropical Pacific, owing to the growth on the films of a variety of fungi. They should be kept in a watertight box constructed of wood which has been soaked in oil. The box should be well painted, and provided with an overlapping lid, so as not to retain any water. Chloride of lime may also be carried in this box as a desiccator.

B.—The Caves of Viti Levu.

The only caves visited in this, the main island of the Fijis, were those contained in the elevated tertiary (?) limestone of Walu Bay and the coast between the Singatoké River and Thuvu (Nandrongá).

The limestones at the Singatoké dip seaward at about 15 to 20 degrees, and consist of soft and hard granular varieties much resembling some sandstones in hand specimens. The fossils are represented principally by pectinoid shells, echinoderm spines, foraminifera, and a very few fungoid corals. In one solitary instance an intercalated coral reef was found.

At Walu Bay the beds are in distinct layers, consisting of soft limestone bands, almost destitute of fossils, alternating with soft belts of coral reef, and reposing on brown and blue layers of volcanic mudstone, locally called "soapstone."

The cavern at the Singatoké lies about 5 miles from the river mouth, and possesses two approaches, one overlooking the sea in the face of a cliff some 300 feet high, and opening on to what at one time was the old channel of the Singatoké; the other entrance being on the flat land above the cliff. Both approaches are hidden by dense growths of palms, vandras, etc.

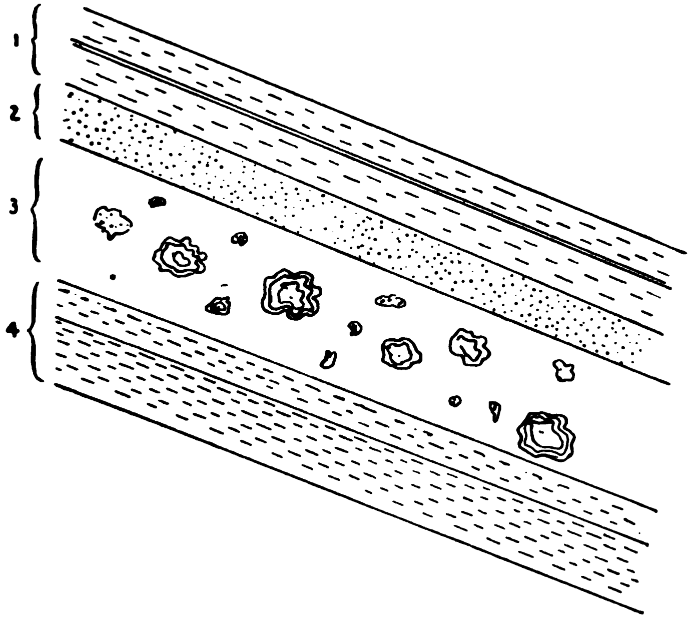

Fig. 1.—Section of Limestone containing Singatoke River Cavern.

1.—Dense red limestone.
2.—Calcareous mudstone.
3.—Coral band (reef).
4.—Red and yellow limestone (granular).

The cave, as far as we could explore it, was 250 yards in length (measured by chain), and very rough in nature. It consists of a series of lofty chambers connected by narrow tunnels, and tiny apertures through which it was at times very difficult to force a way.

The cavern maintains a fairly even dip of some 20°, crossing the bedding of the limestones at a very acute angle, so as to appear to follow their dip.

Some of the chambers were as much as 60 ft. in length, 30 ft. in width, and 50 ft. in height.

The section yielded by the cave is explained in the diagram (fig. 1).

The mouth of the cave is in a dense red limestone. Below this belts of fine calcareous mud are traversed, and beneath these a coral reef occurs, the contained corals belonging to varieties of Porites. Beneath these again mud and granular limestone occur.

This cave possesses stalactitic growths, though not in the marked degree in which they occur in other caves of the group. Thick mud deposits exist on the floor.

An interesting feature of this cave is the occurrence in thousands of the small Fiji bat, called by the natives beke beke. These could be seen covering the roof of the larger chambers, and progress through the narrow tunnels was much hindered by their attempts to pass us. White and apparently blind spiders are of frequent occurrence.

2.—*The Caves of Mata-ni-Vatu.*—Twenty-five miles from the mouth of the Singatoké two enormous cliffs of dolomite occur on the eastern bank of the stream. Their appearance is most imposing. The smaller one shows perpendicular walls to the river 400 to 600 ft. in height. Other parts of the cliffs are not quite so steep, but higher, rising 850 ft. out of the river. The larger cliff is very broken, and is over 1,200 ft. in height.

Caverns open out on these immense cliff faces. Our stay was too limited to admit of any attempt in the way of exploring these dangerous caves, since in certain cases long ropes are necessary to lower the climber from the crags above to the cavern entrances.

Natives who have seen some of the more easily approachable occurrences assert that they partake much of the nature of the Singatoké cave, but are larger, and the underground waters are inhabited by blind fish.

C.—THE CAVES OF LAU.

The Eastern, Windward, or Lau group lies some 150 miles east of the main island of Fiji (Viti Levu). The islands are disposed in a direction approximately meridional, and lie along the axis of a submarine anticline.

The group is about 300 miles in length, and is composed of numerous small islands. Many of these are composed of raised coral limestone. The elevation was not confined to one period, but consisted of uplifts alternating with periods of stable equilibrium, which latter are marked by "terraces" or horizontal extensions seawards of the coral growths, from the older mass of the island. So great has been the total uplift that the basal rocks on which the coral growths flourished may be frequently seen.

These basal rocks consist of huge masses of bedded limestone of moderate dip (15°-25°), differing altogether in lithological characters from the ordinary coral reef limestone.

Again volcanic mudstones form a common base, as also exceedingly decomposed volcanic conglomerates containing gasteropod shells allied to Trochus, Nerita, etc.

Mango, one of the group, may be briefly described as being typical of the raised limestone islands containing numerous caverns. The island is about 4 miles in diameter. It is approximately circular, and presents to the sea at almost all points precipices of raised coral limestone. These are 400 to 500 ft. in height. In former times an unbroken ring of limestone encircled the island, but its integrity has been destroyed by later volcanic outbursts. The perpendicular faces at times are succeeded by escarpments of about 45° slope, and appear to represent the original seaward slope of the atoll, for a raised atoll it appears to be, being hollow in the centre, after the similitude of volcanic craters.

Several traces of elevatory movements exist as more or less imperfect "terraces" or platforms of limestone. This limestone area is covered with great masses of vegetation.

An almost continuous barrier reef runs fairly parallel to the periphery of the island at distances varying from 150 to 300 yards. The coral growths are extremely luxuriant, both in the lagoon and on the seaward edge of the reef. For distances from the surface of 20 to 40 feet these coral growths are wonderfully varied.

The Caves.

1. *Mango.*—The limestone ring is riddled with caverns. Some of these exist in the form of narrow passages connected at times with the outside world by deep shaft-like holes, 100 feet or more in depth. These may be in rare cases varieties of sink or swallow-holes (dolinas).

A cavern in the north-eastern part of the island opens out in a great cliff face, and is about 200 ft. above sea level. It consists of several large apartments varying from 10 to 40 feet in length. Stalactitic, stalagmitic, and "shawl" growths are common.

Another cave in the north-east has two entrances, one in the form of a gigantic chimney 120 ft. in depth, the other occurring at the base of a cliff. This cavern consists of several systems of chambers branching out from each other, all very large, and needing the assistance of ropes in their exploration. Stalactitic growths are of frequent occurrence. The bottom chamber, 130 ft. below the cave mouth, is very spacious and contains hundreds of swallows' nests composed of mud.

To the north a very large swallow-hole occurs 120 ft. in depth. This connects below with a long tortuous channel running normally to the direction of the chimney, and conveys the drainage of the northern part of the island to the sea. This cave must be [illegible] yards in length.

Another large cave occurs in the north-west. The mouth is [illegible], but affords entrance to a large hall [illegible] ft. long, 100 ft. wide, and some [illegible] ft. high, and possessed of a great wealth of stalactites and stalagmites.

Several branches [illegible] the respective points of departure from this [illegible] are [illegible] very large, exceedingly [illegible], and dangerous for [illegible] of explorers. Large gaping holes occur throughout its 300 yards of length, and numerous subsidiary caverns ramify from the parent trunk. Other chambers of considerable size occur in a cliff to the south.

2. *Thithia.*—This island is almost a replica of Mango in every particular. Its caverns, however, partake more of the nature of lofty halls than long tunnels. Stalactites and stalagmites of great size occur in abundance. Immense deposits of bat guano cover the floors. In one cave a deposit 18 ft. deep was worked. The excessive moisture is said, however, to militate against the ready sale of these manures.

3. *Lakemba.*—A large cave occurs in one of the irregularly scattered patches of limestone existent on this island. The cavern is curvilinear in shape, not advancing directly into the hill, but turning back somewhat on itself from the start, so as to give the appearance, in plan, of a horseshoe with reduced convexity. It is a magnificent example of cave formation and worthy to rank among occurrences like Jenolan in point of size, though not in beauty. The floor, contrary to the usual type, is almost level, very wide, and covered with a thick deposit of mud. It is in the form of two large chambers, each about 300 yards in length, 50 ft. in width, and 50 ft. in height. A row of columns (stalactites) separates the caverns.

The roof is like that of a church, having a long central ridge, with two steeply inclined sides. Huge grey and white stalactites of irregular shape depend from the roof.

4. *Nghillanghillah.*—A marvellously beautiful little cave occurs in one of the islets forming the Nghillanghillah Group.* All of the raised coralline rocks composing the islets possess deep undercut lines of beach erosion. One is about 100 feet high, 20 yards in diameter at the base and cylindrico-conical in shape. It is merely a limestone shell, the central portion being absent. The internal contour is approximately a reflex of the exterior. Tiny entrances occur in the undercut portions, through which the sea has free

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* A. Agassiz, Bull. Mus. Comp. Zoology, Harvard Coll. Vol. xxxiii. p. 91.

access to the cave, the floor of which is occupied by about 5 feet of water. The roof is about 75 feet above the floor (fig. 2).

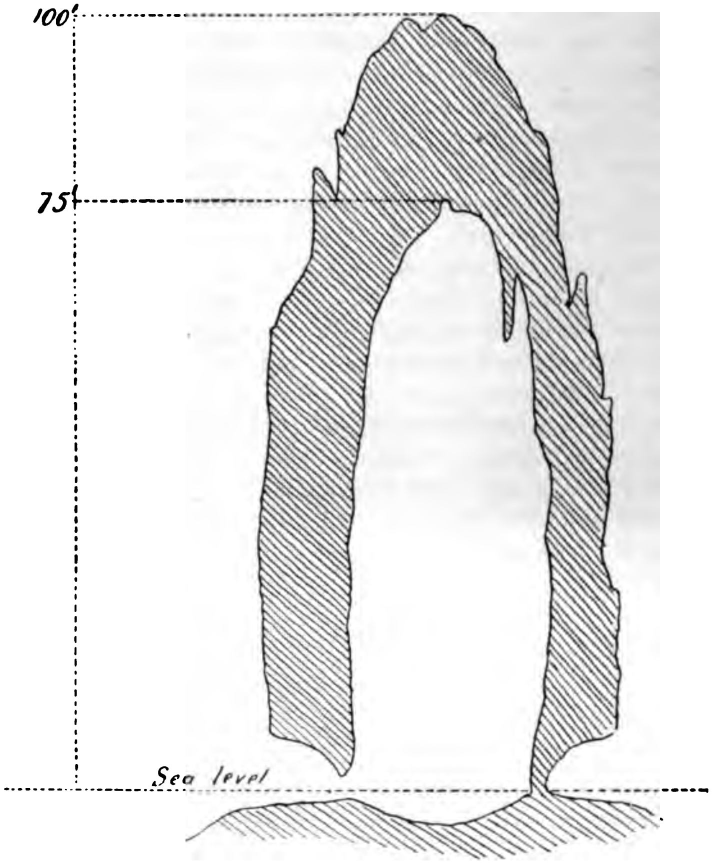

Fig. 2.—SKETCH SECTION OF NGHILLANGHILLAH CAVE.

5. *Bai Vatu.*—The mass of raised limestone known by this name is separated from Nghillanghillah by a deep though narrow channel. On the western and eastern sides huge cliffs occur, 400 feet in height. Many caverns are said to exist in this area.

One, however, only was seen by us, the others being difficult of approach. The occurrence was similar to the caves of Thithia.

6. *Vatu Leile.*—This island contains caverns on its west coast, partly submarine in habit. They occur at the base of large cliffs, and are of very irregular shape, having the form of large chambers communicating with the sea (lagoon) by means of submarine conduits. They are approachable from the land side by openings in the limestone shell encasing them. The cave waters contain multitudes of speckled scarlet prawns of large size. This is a unique occurrence.

Numerous caves are reported to exist in the raised limestone of Katavanga, Naitamba, Gamia, Tuvuthá, Vanua Vatu, the Yangasa and Yasawa clusters. These are said to be similar in character to those of Mango or Thithia.

D.—THE CREVASSES IN THE SUBMARINE REEF-PLATFORMS.

Some of the platforms fringing the various islands of the Lau Group are marvellously cut up by networks of channels. On passing over them at high tide in a small boat the general flat of the reef is seen to be broken repeatedly by chasms and lenticularly-shaped chambers.

At Vatu Vara one of these cracks has perpendicular walls, is about 20 feet across, and is at least 200 feet deep. This great depth was not continued throughout the reef to the sea, but shallows away to nothing at the reef edge.

At a depth it appeared to open out into chamber form.*

At Kambara the whole reef flat is broken up by a series of deep cracks.

The walls of these crevasses are composed of luxuriant growths of Madrepores, Porites, Pocillopora, etc.

Mango furnishes similar sights, though on a much smaller scale.

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* It is quite easy to see objects at a depth of 100-120 feet in these clear seas, and this too without the aid of water glasses.

Every island navigator is familiar with the deep clefts in the fringing reefs of the shallow Somo Somo Strait at Taviuni.

A characteristic feature is the arched appearance they frequently present to the sky, having narrow openings at water level, and a series of wider anastomosing canals below.

Now, in Vatu Leile, as explained in a previous paragraph, we have caves partly under and partly above water, the whole appearance being that of a series of chambers with a few narrow passages opening upwards and outwards to the sky.

Near Tuanuku, in the Vavau Group (Tonga), a beautiful cave exists in the raised limestone. This also is half-submerged, yet of such a size that we sailed a cutter, with mast up, right into the cavern. The highest part of this chamber must have been 70 feet above water level, and the water inside the cavern was of equal depth. This chamber was connected with others by passages, and opened to the sky by a small hole.

It seems that here we have a condition of things attainable by suddenly raising the present fringing reefs of Kambara and Vatu Vara, so as to leave the crevasses and chambers half submerged.

E.—1. Description of Cave-Formation generally.

Acidulated water (deriving its acidity from decaying vegetation, &c.) trickling over limestone, attacks the rock mass, carrying it away, little by little, in solution. In this way, by attacking the rock along the joint-planes, swallow- and sink-holes are formed in the limestone mass. These, after a time, may become united at a depth through the continued action of the percolating waters. Eventually a subterranean watercourse is formed, and the shape of the excavation is that of a series of chambers united by tortuous passages.

When a cave has been excavated, the water still eats into the the stone, and other sink-holes being formed below its level, the old stream bed is deserted in favour of a newer and lower one.

The process of refilling now sets in at the upper level.

Water trickling down and from the roof allows of an infinitesimal amount of evaporation. This is, however, sufficient to permit of a tiny deposit of carbonate of lime on the roof or floor. These deposits, as time goes on, take on the form so common in cave scenery, such as stalactitic, stalagmitic and shawl-like growths.

2. *Origin of the Viti Levu Caves.*—These are very probably due to agencies which determine cave-formations generally, as described in the preceding paragraph.

For the limestones in which they occur both at the mouth of the Singatoké River and 25 miles higher up the stream show bedding planes as pronounced as those of the Hawkesbury sandstone, and, with the exception of a single intercalated coral reef and a few scattered fragments, are utterly devoid of coral growths. They are also of sandy nature, after the fashion of compacted braches, and are thus composed of waste sheets. The cave also in the limestone at the Singatoké mouth follows the bedding of the strata for long distances, and contains *very thick* deposits of mud on the floor.

These observations point to formation subsequent to the limestone deposition, although it is possible that the initial stages were determined by submarine agencies, post-dating the formation of the strata.

3. *Origin of Lau Caves* —These appear to be moulded on lines totally different to those obtaining at Viti Levu. Whereas the majority of caves owe their existence to hypogene agencies, it seems more feasible to refer the origin of the typical Lau caverns to submarine action modified to minor extent only by hypogene influences.

It may not be generally known that the greater number of modern "reefs," such as those of Fiji, are composed of coralline débris, foraminiferal tests, echinoderms, mollusc shells and vast quantities of calcareous algæ (such as Halimedæ and Nullipores). Calcareous matter is also deposited between the tiny interstices of these fragments until the mass assumes a homogeneous appearance.

On the seaward edge of these, however, luxuriant coral and nullipore growths occur. It is also very common in the lagoons to see huge isolated masses of growing coral. As these masses expand, there is a tendency for the isolated patches to coalesce by fusion of the growing walls. Withal, however, channels are frequently left between the clumps, probably to permit of circulating waters conveying nutriment to all. The coalescence or fusion of the expanding growths is most marked towards the sea level, the tendency being to form arches overhead and to leave a series of anastomosing canals below, broadening here and there into chambers. Nullipores also help considerably in the work of solidifying the mass and the closing in of the overhead growths.

The appearance of the structure just described, viewed from a short distance, is that of a solid reef-platform flush with the sea level.

The study of such fringing reefs as those of Taviuni (Somo Somo Strait), Mango, Vatu Vara, Lakemba and Kambara will illustrate the foregoing remarks.

Prof. David, of Sydney University, and Mr. C. Hedley,* of the Australian Museum, mention the arching over of the submarine channels of Funafuti by coral, nullipore and allied growths.

On the Tonga Tabu coast, numerous "blow-holes" occur in the reefs. These consist of long submarine conduits in the fringing coralline limestone mass, opening out to the sky by constricted orifices.† Into the wide mouths of these tunnels the sea dashes, and becoming confined as the way becomes narrower, is dashed into the air as spray by the on-rushing water behind.

Prof. David mentions similar, though smaller, occurrences at Funafuti.

At Wangava, in southern Lau, a central salt lagoon exists, shut in from the sea on all sides by high limestone cliffs. The tide is said to rise in the lagoon, thus showing its connection with the outer sea by a long, submarine passage.

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* C. Hedley, Natural Science, xii., 1898, p. 177.

† For this information we are indebted to Mr. J. Martin of Auckland.

At Namuka, in the Tongan Group, one of us witnessed a similar phenomenon.

It seems very probable that the caves of Vatu Leile and Vavau have been formed by processes such as those just described, and that they mark stages in the process of reef-making.

At Vatu Leile there are unmistakable signs of recent upheavals, the whole series of elevations (5 in number) being of so recent a date that the line of beach erosion on the cliff which marks the position of stable equilibrium before the elevatory influences came into play has not yet been obliterated.

Again, above the caves a thin crust of limestone occurs, marking the old reef-platform. Where this old platform ends against the cliff another line of beach erosion exists, and that nearly perfect. It will thus be seen that these large half-marine, half-aerial chambers must have been excavated while the line of beach erosion suffered but very slight alteration, if we assume that æolian agencies have been the prime factors in their formation.

At Vavau we have a very similar state of things. Here the uplifts are 3 or 4 in number. It is, however, possible that the lines of beach erosion may suggest another method of formation for these caverns.

In Mango and Thithia the broader outlines of the caverns seem to have been determined by submarine agencies.

It is impossible to ascertain the exact condition of the cave-walls, as they existed beneath the sea, since secondary deposits of calcareous material have so covered them as to obscure their original shape.

Stalactites, stalagmites and shawl-like growths do not appear to imply great periods of time, as may be seen by an examination of the most recent of the raised lines of beach erosion on Vatu Leile. This is in places where the cliff overhangs almost entirely obliterated by stalactitic deposits, while in other portions of the island the line of beach erosion is almost as intact as when it rose from the sea.

To summarise, then, it seems probable that :—

(*a*) The limestone fringing the shores of Viti Levu is mostly of stratified and shelly character, with rarely intercalated reefs.

(One such reef only was observed by us at the Singatoké River, and several at Walu Bay and Tamavua.[*])

The caves of Viti Levu exist in rocks possessing most pronounced dips, varying from 10° to 20° in amount.

(β) The Lau limestone is of later origin than the bedded Viti Levu deposits, as shown at Bai Vatu where coral reefs form thin crusts only on thick bedded masses of limestone indistinguishable in lithological characteristics from those at the mouth of the Singatoké River.

The Lau caves occur in compact, hard limestone formed of corals, shells and calcareous algæ and exhibiting no bedding planes.

(γ) The Viti Levu caves appear to possess an origin similar to that of caves existing in continental areas, where æolian agencies have been the designers.

(δ) The Lau caves appear to have been determined by coral growths and submarine action, and owe their stalactitic growths to influences acting subsequently to their elevation above sea level.

F.—Description of Access to Caves.

Frequently the entrances to the caves occur in the faces of the cliffs as apertures, invisible, except on close inspection, by reason of the rough nature of the rock and the mantle of vines and shrubs that invariably accompany the raised limestone areas. Others again are approachable only by descending one of the deep cracks that intersect the limestone in all directions.

It is impossible for one unaccustomed to similar sights to appreciate either the roughness of the raised reefs[†] or the dense growths that cover them.

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[*] J. S. Gardiner, Proc. Cambridge Phil. Soc. Vol. ix. 1898, p. 425.

[†] A. Agassiz, Bull. Mus. Comp. Zool. Harvard Coll. Vol. xxxiii. Pl. 98.

People, unless good climbers, are frequently unable to cross the limestone belts that surround the island, owing to the cracks or crevasses present, which are at times as much as 100 to 150 feet deep, although not more than 10 or 12 feet wide.

The vegetation is even more wonderful, both by reason of its luxuriance and its method of securing itself to the rock.

Although almost devoid of soil, the raised coral rock supports a dense forest growth that cuts off the direct rays of the sun from the ground beneath. The trees swarm down even almost perpendicular limestone scarps. Supplied with the power of expanding their roots in tubercle fashion, they make capital out of every little irregularity of surface. At each hole in the honeycombed rock they stop to fill up the cavity, then advance ivy-like roots to the next depression.

The vandra (screw pine) develops spiny aerial roots which depend from the rocks in a scalariform manner.

Perhaps the most wonderful of all these growths, however, are the fig trees and the various members of the convolvulus tribe.

In some of the islands the only method of approach to the caves is by descending the long fig tree roots.

G.—Caves as Dwellings and Fortresses.

The inhabitants of Lau until quite recently lived an almost Ishmaelite existence. The various island tribes fought desperately with each other for supremacy, and even the people belonging to any given island were divided among themselves.

On such a small area as Mango as many as three or four distinct cliques existed, each antagonistic to the other. The highest and most inaccessible points, which formed natural fortresses, were chosen as watch towers, from which the sentinels estimated daily their chances of conquering or being conquered.*

In almost every instance which came under our observation, the excessively rough limestone cliffs formed these points of vantage. Near at hand were the caves we have described.

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* For this information we are indebted to the Hon. J. M. Borron, of Mango.

Almost invariably the isolated and almost inaccessible limestone plateaux contained large heaps of shells of various kinds, the remnants of shellfish brought from the seashore for food.

The rough nature of the limestone and the dense covering of vegetation made it impossible for a surprise to be sprung upon the concealed township, as the sentinels could give timely warning.

A very interesting feature about the caves existing in the close neighbourhood of these shell mounds is the existence of the numerous "Bai Valu" or fighting walls, seen so frequently in the various Lau islands. The caves often open out into cañons. The mouths of these defiles are set with walls of stone, breast high. Every approach is guarded with them, and outlying walls support these in turn. We have seen as many as a dozen of these walls belonging to a single cavern. In cases where caves exist in the cliff faces, the defiles below are accompanied by these walls (*e.g.*, Mango and Bai Vatu). At Bai Vatu some of the walls are very lengthy, and overlook steep sloping ground.

We were informed by the Hon. J. M. Borron, Mr. F. Beddoes, of Mango, and others, that these caves were used as retreats for the women in the olden days in times of war, while the warriors defended the walls. On the other hand, Dr. B. G. Corney, chief medical officer of Fiji, says that to the best of his knowledge they were used simply as burial places. In one cave one of us (B. Sawyer) discovered three skeletons laid side by side. In another chamber we discovered relics of former feasts. Some of these consist of large brain corals, having the original flat surfaces worn hollow by scraping kava on them. These are known as "yangona scrapers."

The existence of these caves in rough country, the concealment of their entrances, the numbers of the "Bai Valu" closing every way of approach to the more inaccessible ones, the existence of "yangona scrapers," etc., the discoveries of skeletons in the cave recesses, and the proximity of the underground chambers to the large shell-mounds of the limestone plateau seem to point both to their habitation in former times by natives in time of war, and to their use as burial places.

BACTERIA AND THE DISINTEGRATION OF CEMENT.

By R. Greig Smith, M.Sc., Macleay Bacteriologist
to the Society.

Occasionally the cement work of water canals and reservoirs disintegrates below the water level, and instead of showing a smooth and apparently hard face, the surface is seen to be more or less eroded. When struck with a pick, the cement easily comes away, and a porous internal structure is revealed. The cement matrix has disappeared, and the sand, grit and stones are practically all that remain. Above the water line the cement remains quite hard, and shows no sign of disintegration.

Stutzer and Hartleb* investigated such a case, and as a result of their work, they considered that the nitrous organisms—that is, bacteria which convert ammonia into nitrous acid—might assist in the decomposition of the cement, through the production of nitrous acid, which dissolves the lime forming the soluble calcium nitrite. They worked upon a sample of brownish coloured mud taken from the bottom of the Bonn water reservoir. Chemically it proved to be disintegrated cement, and bacteriologically it was found capable of causing the nitrification of a solution of ammonium sulphate.

Barth,† in publishing his experience with hydraulic cements, said that a destruction of the cement might take place in so relatively short a time as three years. In the case which came under his notice, the water did not contain an excess of free carbonic acid and the decomposition of the cement seemed unaccountable. When the reservoir was faced with a cement containing a percentage of silica higher than the original cement, no further disintegration was observed.

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* Stutzer and Hartleb, Zeit. für angew. Chemie, 1899 (17) 402; Abstract in Jour. Soc. Chem. Industry, xviii. 495.

† Barth, *ibid.*, 1899 (21) 489; Abstract, *ibid.*, xviii. 686.

A disintegration of the cement canals used in conveying the Sydney water supply has been observed for some time by the engineers. Acting under instructions from the Council of this Society, and upon the invitation of Mr. Darley, Engineer-in-Chief for Public Works, I visited the faulty canals on September 8th, 1900, under the guidance of Mr. Smail, Engineer to the Metropolitan Water Supply Board, and collected samples for laboratory examination.

The cement above the water line was absolutely hard, while below the water it was soft, and the surface could be easily scraped off with a blunt nickel spatula to a depth varying from $\frac{1}{16}$ to $\frac{1}{8}$ inch. To get samples deeper into the cement a pick was used. The material easily broke away. The samples included the blackish sediment at the bottom of the canal, a scraping from the surface of the side, and the sandy débris at depths of one, four and six inches.

So far as the history of the cement is concerned, the canal was made some 18 years ago, when, I am informed, cement was bought by the brand, whereas now all cements are tested physically by the Board before purchase. This should be borne in mind, because the disintegration may be purely and primarily chemical and not at all the result of chemical action induced by living micro-organisms.

In endeavouring to obtain organisms which might cause the disintegration, it would obviously be useless to separate all the bacteria that are present in the samples. Since the cement is impregnated with water, all the organisms that are in the water would be found. We ought rather to try to exclude bacteria which would not be expected to have an action upon the cement. This means the employment of methods of culture or media as permit the growth only of such organisms. To fix upon these methods or media certain hypotheses regarding the behaviour of the bacteria must first be formulated. Stutzer and Hartleb would probably have first formed the hypothesis regarding the action of nitrifying organisms, and then have endeavoured to induce nitrification in a solution of ammonium sulphate. The dilute solution of ammonium sulphate employed in testing nitrification is a selective medium, since it favours the growth of the nitrous organisms and hinders the multiplication of others. Since nitrification has been suggested, one of the points of this investigation should be to test the idea, and see to what extent it is corroborated.

Another idea that gives the cue for a selective medium is based upon the disintegration of the cement through loss of lime. Whether it is removed as the hydrate, the bicarbonate, or other salt, *e.g.*, nitrite, we cannot tell. It is probable, however, that the surfaces of the disintegrating cement particles are more or less alkaline, and if such is the case the bacteria that can withstand or grow only in the presence of alkali are more likely to be responsible for the disintegration than those which show an antipathy to alkaline media. The majority of bacteria prefer small amounts of alkali, say a medium containing 0·05 % sodium carbonate, but there are not so many that can grow in a medium as alkaline as lime water, which contains 0·28 % calcium oxide. It may be said in parenthesis that the bacteria which normally inhabit the intestinal tract of mammals can grow in media containing at least 0·75 % sodium carbonate, but as I have indicated in a former paper, the water which supplies Sydney is pure, and therefore the possible presence of these organisms may be dismissed. There is, however, the question of what bacteria in the disintegrated cement can be separated by means of increasing amounts of alkali. Sodium carbonate is the most convenient alkali to use, since it is soluble and does not alter during the processes of sterilising the media and growing the organisms. Lime would be the ideal alkali to employ in this case, but its relative insolubility and its tendency to form the insoluble carbonate precludes its use.

The fluid on the surfaces of the cement particles cannot contain much nitrogenous nutriment, and consequently those bacteria which can grow and therefore be isolated in media which contain minute quantities of nitrogenous material are more likely to be the cause of the cement disintegration (if it be bacterial) than organisms which cannot grow under such circumstances.

There are accordingly three lines of research indicated, and of these I shall begin with the nitrification. Several 100 c.c. bottles were half filled with ammonium sulphate nutrient solution,* plugged with cotton wool and sterilised. Portions of the samples of the disintegrated cement were introduced and the bottles incubated at 22° C. No nitrification had set in when they were tested after 1, 5, 13, and 39 days respectively. On the 65th day, when they were again tested, nitrites were found in quantity in two bottles, one of which had been infected with material taken from the surface of a cemented crack at the bottom of the canal, and the other with mud also taken from the bottom of the canal. On the 81st and on the 101st day the bottles were again tested, and the same fact observed. Two fresh bottles of ammonium sulphate were inoculated with a small loop of the nitrifying solutions, and nitrites were found in these on the fourth day.

It is seen that nitrification was obtained in the solutions of ammonium sulphate that were infected with the surface layer of the cement and with the mud at the bottom of the canal. It was not obtained in the cement at the depths of one, four, and six inches. This is important, because disintegration was in progress at these depths in the cement wall, and if the nitrifying organisms contribute at all to the decomposition of the cement, they should have been found at these places, and not only on the surface where the material had become thoroughly disintegrated. Stutzer and Hartleb found the nitrifying organisms in the mud at the bottom of a cement reservoir. This is exactly what has been found in these experiments, but furthermore they were not found in the disintegrating cement below the surface. This points to the nitrifying organisms coming upon the scene at a late period when disintegration is complete and when a considerable amount of organic matter derived from algæ, etc., is present in the brown and black débris.

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* Ammonium sulphate 2 grms., sodium carbonate 1 grm., potassium dihydrogen phosphate 0·1 grm., tap water 1000 c.c. as recommended by Stutzer.

The next line of investigation was the separation of organisms that could multiply in the presence of an alkali such as sodium carbonate. Taking the disintegrated cement obtained at a depth of six inches into the canal face as being the sample most likely to contain bacteria capable of causing disintegration, portions were introduced into tubes containing 10 c.c. of bouillon and quantities of alkali varying from 0·5 to 1·0 c.c. were added. The tubes became turbid and orange-coloured colonies of one type developed on plates inoculated with the growth of the tube containing the highest amount of alkali. Subcultures of the organism showed it to be *Bact. croceum*,* a bacterium which had previously been isolated from the Sydney water. It grows well at 37° C., and this temperature was employed in subsequent trials with further increasing amounts of alkali. These trials showed that a turbidity, the evidence of growth, took place in the presence of equal volumes of 10 % sodium carbonate solution and bouillon, that is, the bacterium developed in the presence of 5 % by weight of sodium carbonate. A percentage greater than 5 prevented the growth entirely. Plate cultures from the 5 % bouillon culture showed the turbidity to have been caused by the growth of the organism, while plates infected from the clear tubes containing over 5 % remained sterile It is needless to say that the bacterium grew in bouillon containing less than 5 % sodium carbonate ($Na_2 CO_3$). With the exception of *Bact. croceum*, all the bacteria in the deep cement were inhibited by 0·5 % sodium carbonate at a temperature of 37° C.

This organism is remarkable in being able to withstand so much alkali. The records as to the limiting amount of sodium carbonate capable of permitting the growth of bacteria are few in number. Reinsch[†] in experimenting with the Elbe water below Hamburg found that 2 % permitted the growth of some unidentified water bacteria, while 3 % did not. Fermi[‡] has recorded the action of potassium hydrate upon many micro-organisms. Excluding the micrococci, which appear to be less influenced by the presence of this alkali in culture-media than rod-shaped bacteria, the organism that can withstand most potassium hydrate is *Bact. luteum*, a yellow bacterium which has some affinities with *Bact. croceum*. The growth of *Bact. luteum* is inhibited when 12 drops (= 0·6 c.c.) of normal potassium hydrate have been added to 5 c.c. of nutrient agar. This is equal to 0·67 % of potassium hydrate. Experiments with *Bact. croceum* showed that growth occurred in the presence of 1·6 % potassium hydrate, but no growth took place when double that amount was used.

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* These Proceedings, 1900, Part iii., p. 456.

The presence in the cement of an organism capable of growing with so much alkali is noteworthy. It is also significant that the same organism was found at depths of four and six inches in one place, but also at a depth of four inches into the disintegrating cement face in another portion of the canal below Prospect Reservoir, some miles distant from Kenny Hill, from where the first samples were obtained. The indifference of the organism to the alkali does not warrant the assumption that it is the cause of the disintegration, but there is the possibility that it may have something to do with it. To obtain some knowledge concerning its action, an experiment was made with cement blocks. These consisted of equal volumes of sand and old cement, and also of two volumes of sand to one of new cement. When they had hardened and had been sterilised, a culture of *Bact. croceum* was painted on the surface of the blocks with a platinum loop and the infected blocks were placed on a glass shelf in a desiccator which was filled up to the level of the blocks with boiled and cooled tap water. The whole vessel had been sterilised, and the water, which was renewed weekly by way of a side tube, was boiled and cooled before being filled into the vessel. The desiccator was kept at 28° C. for five months. At the end of this time the surfaces of the blocks were scratched with a spatula, but no erosion or softening could be detected in the places where the culture had been placed. It is possible that the time was not long enough, and that years are necessary instead of months, while on the other hand the cements were not the same as that with which the canal was made. However, the experiment, such as it was, gave only negative information regarding the action of the bacterium.

[†] Reinsch, Centralblatt für Bakt. i. Abt., x. 415.

[‡] Fermi, *ibid.* xxiii, 208.

Another line of investigation was to discover any organism capable of growing in a poor medium and likely to cause cement disintegration. To isolate such, a solution of asparagin (0·1%), cement (1%) and tap water was prepared, and bottles containing this medium were infected with portions of the samples and incubated at 22° C. A mixed growth appeared in all the bottles, especially those infected with the cement from depths of four and six inches. From these other bottles were infected, and after 10 days agar plates were prepared. The agar medium consisted of washed agar with cement and asparagin, the percentages being the same as those mentioned above. A third transference into asparagin-cement solution appeared to exhaust the bacteria, as no growth was microscopically visible after 30 days. The agar plates were infected with the cultures from the cements taken at a depth of four and of six inches. The former produced two kinds of colony and the latter one kind. Of the three, two were identical and sub-cultures which were made showed it to be *Vibrio denitrificans*, Sewerin. The other organism was a coccus of variable size, and when stained of irregular appearance. Subcultures showed it to be *Mic. radiatus*. When these two organisms were grown upon cement blocks, as was done with *Bact. croceum*, no disintegration of the cement could be observed on the places where the culture had been placed. From this we must assume that although probably capable of growing in the fluid on the surfaces of the cement particles, these two organisms have no disintegrating action upon cement.

The presence of a denitrifying organism deep in the cement is neither an argument for nor against the action of the nitrite organisms upon the cement. *Vibrio denitrificans* reduces nitrate, but not nitrite, and in order to form the nitrate the lime of the cement must first be converted into calcium nitrate. The presence of *Vibrio denitrificans*, however, does not necessitate the presence of nitrates. They are not essential to its existence. It can grow freely in media devoid of them, so that the reduction is purely an accessory phenomenon. Moreover no nitrification was obtained on seeding solutions of ammonium sulphate with portions of the deep cement where disintegration was in active progress, and where the denitrifying organism was found.

There are doubtless many bacteria in the decomposing cement that can form acid from carbohydrates, but in the water and the cement there are no carbohydrates, or if there are they are present in such minute traces that they may be ignored. There is a possibility that acid might be formed by bacteria in the absence of carbohydrates, and to test this point neutralised asparagin-cement-water was coloured with litmus and infected with the samples. No change of colour became evident after two months' culture, so that the possibility of acid formation by bacteria in the interstices of the cement may be dismissed.

On the whole there is considerable room for doubt regarding the action of micro-organisms upon cement. There is more reason to believe that the action is purely chemical, and brought about by the decomposing and solvent action of the water alone upon the cement which probably has not been adapted for resisting the action. The débris had an alkaline reaction to litmus, and I noted that in the bottles in which I endeavoured to obtain nitrification of an ammonium sulphate solution there had formed upon the glass a considerable incrustation of crystals of calcium carbonate. It seemed peculiar that this should occur with a sample which, to all appearance, was reddish-yellow sand and grit. Curious to know the amount of free lime in the sample, I added 5 grms. of saccharose to 500 c c. of boiled and cooled distilled water, and after adding a few drops of phenolphthalein neutralised the solution with decinormal alkali. Two grms. of the unsifted débris (taken from a depth of four inches) were introduced into the flask containing the solution, and after being shaken at intervals during a day, the solution was filtered and titrated with decinormal acid. The determination showed that there was 1·4% of free lime (CaO) in the débris.

With regard to the composition of hardened cement there are several theories. It is not a substance of constant composition, and as the percentages of the constituents differ in every brand only those that actively play a part in the hardening need be considered. According to Le Chatelier, hardened cement consists of hexagonal plates of crystallised calcium hydrate imbedded in a white mass of interlacing needle-shaped crystals of hydrated calcium monosilicate. Michaeli considers that the hardening is caused by the formation of a hydrated basic calcium silicate through the combination of free hydrated silicic acid with free calcium hydroxide. Of more recent date are the Newberrys' researches upon the essential constituents of Portland cement which they find to be such that form on the addition of water, tricalcium silicate and varying proportions of dicalcium aluminate.

It is evident that lime in the hardened cement, capable of being dissolved, is a source of weakness, and it will sooner or later be dissolved by the water. It can, therefore, hardly be doubted that a cement which, after hardening, has become disintegrated and porous after exposure to water for a number of years, and which still contains 1·4% of free lime capable of being dissolved, was not of a nature likely to withstand the·action of water.

In a paper published three years before that already quoted, Stutzer* ascribed the disintegration of the cement to the solvent action of carbon dioxide dissolved in the water. Basing his opinions upon the observations of Michaeli, he considered that the addition of an active form of silica such as trass to the cement would, on setting, bring about the formation of calcium silicate instead of free lime. Barth, by facing the disintegrating canals with a cement containing a higher percentage of silica, showed the importance of minimising the free lime in hardened cement subjected to the action of water. Schiffner† concluded from the results of experiments conducted upon the Bonn reservoir (the disintegrated cement of which Stutzer investigated) that no calcareous material is capable of permanently resisting the action of running water. "As regards protective coatings for cement-lined reservoirs, an experience of 33 months teaches that the fluorine preparations sold for this purpose give satisfactory results; and oxalic acid and ammonium oxalate (the latter being best) also considerably retard the corrosion. Similarly asphaltum varnish preserves the cement."

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* Stutzer, Zeit. für angew. Chemie, 1896 (11) 317; Abstract in Jour. Soc Chem. Industry, xv. 595.

Postscript (*added May 16th, 1901*).—In the discussion that followed the reading of this paper, it was suggested that the lime had in the experiment been dissolved as a silicate, because it seemed incredible that there could be free lime in the exhibited sample of disintegrated cement. I was led to the conclusion that it was there as free lime by the relatively abundant formation of calcium carbonate crystals on the walls of the culture flasks. To test the matter thoroughly, however, I repeated the experiment, using 5 grms. of sample and 1 litre of boiled and cooled neutral distilled water. After three days the solution was filtered, neutralised with standard acid and evaporated to dryness. The silica was coagulated by repeated evaporation with concentrated hydrochloric acid, followed by heating at 130° C. The results showed that there had been dissolved in the water 39 mgrm. calcium oxide and 1 mgrm. silica, a ratio of $CaO : SiO_2 :: 42 : 1$. This is enough to confirm the supposition that the lime is dissolved in the free state and not as silicate. On calculating the calcium oxide to percentage in the sample, 0·78% is obtained. I attribute the difference between this result and the former one chiefly to the lime having become carbonated during the six months' storage in the sample bottle.

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† Schiffner, Thonind. Zeit. 24 (100, Suppl.) 1320-1321; Abstract in Jour. Soc. Chem. Industry, xix. 1114.

The fluid in one of the culture flasks was filtered, and the dissolved silica found to be 1·5 mgrm. The sand in the bottle was washed away by a stream of water, and the grains adhering to the bottom scraped off. After everything excepting the incrustation of carbonate on the wall had been removed, standard acid was run in and allowed to decompose the carbonate. The carbon dioxide was removed and the residual acidity determined. The difference was found to be equal to 22 mgrms. calcium oxide. The small amount of silica in solution in the culture flasks corroborates the conclusion that was arrived at from the observation of the incrustation.

NOTES ON *VIBRIO DENITRIFICANS*, SEWERIN.

By R. Greig Smith, M.Sc., Macleay Bacteriologist to the Society.

(Plate xi.)

In examining the bacteria contained in a sample of disintegrating cement which was obtained from one of the canals used for conveying the Sydney Water Supply, an organism which had some curious features was isolated. It is identical in form with *Rhizobium leguminosarum*, the nodule organism of the Leguminosæ, but differs from it in the power of growing on ordinary media as well as in media containing little nutriment. Although so like the nodule organism which is supposed to convert free nitrogen into combined forms or to assist the plant to do so, this organism does almost exactly the opposite and reduces nitrate to nitrogen gas.

The investigation of the organism in subculture showed it to be *Vibrio denitrificans*, Sewerin, but for some time it could not be identified with this organism, because a true vibrion form could not be observed. By using a low magnification and observing overstained films, bent forms can be seen, but by examining a properly stained film with the oil-immersion (No. 4 ocular and $\frac{1}{12}$ oil objective, Leitz) the bent forms are clearly seen to be double organisms bent at the point of attachment. The individual cells are straight.

Like *Rhizobium leguminosarum*, the organisms appear in a variety of forms, as the coccus (0·8 μ), oval cells (0·6 : 1·0 μ), rods with rounded ends (0·6 : 2 μ), exclamation mark (!), conical cells, γ, Y and double cells bent at an angle. They stain readily with carbol-violet, and show unstained portions which are not constant in location, being generally between the middle and end of the cell. In the Y-shaped forms the compound nature may be discerned, and it is seen to consist of three organisms enclosed in a branching capsule or tube. The γ-forms are made up of a rod and one or two smaller cells; the latter may spring from the end of the rod perpendicular to the plane of the film, and become bent over at right angles, or nearly so, during the process of drying the coverglass. The various forms are most numerous in cultures upon solid media containing potassium phosphate. Such a medium can be prepared by adding 10% gelatine or 2% agar to the peptone-glucose solution recommended in a former paper.* In a two days' culture upon this gelatine medium all the variety of forms can been seen. The plate which accompanies this paper was prepared from a film of such a culture; the cells were stained with carbol-violet.

The organisms as observed in the hanging drop are motile, spinning round and darting about the microscopic field. The flagella are generally two in number and located at one end of the simple cell, but they also occur singly at one end, and sometimes at both ends, of the organism.

The optimum temperature is 28-30° C., and although it grows at 37° on solid media the growth is restricted. In opposition to Sewerin I find that there is practically no growth in nutrient or nitrate bouillon at 37°. Under anaerobic conditions, it forms a scanty growth on agar. On ordinary acid potato the growth is luxuriant, moist glistening, creamy-white and spreading; the colour ultimately becomes brownish-yellow. Sewerin† in his first paper said no growth occurred on potato, and in his second that there was formed a narrow, flat, yellow-brown, dry stroke. The other cultural characteristics agree with Sewerin's description. It may be well, however, to point out that there are many similarities in the growth of this organism with *Bact. Hartlebii.*

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* These Proceedings, 1899, Part 4, p. 661.

† Sewerin, Centralblatt für Bakt. ii. Abt. i., 162; iii., 510.

The main points of difference are that *Bact. Hartlebii* grows well in nitrate and ordinary bouillon at 37°, gas production is more vigorous at 22°, and it is a short rod without the vagaries of form which occur in *Vibrio denitrificans.*

The swollen organisms as depicted by Sewerin are similar to those found in cultures of *Rhizobium leguminosarum*. As I have shown in my paper on the latter organism, the appearance is due to a swollen gelatinous capsule which gathers round the junctions of the organisms.

It is unfortunate that Sewerin named the organism *Vibrio*. He apparently mistook the bent double cells for simple cells, and was influenced by Zettnow, who published drawings of *Vibrio rugula*, some of which are similar to the Y- and γ-forms of Sewerin's organism. I have already pointed out that *Rhizobium leguminosarum* is a budding fungus, and there is every reason to believe that *Vibrio denitrificans* is precisely of the same order. As it simulates a bacterium, the name *Mycobacterium denitrificans* would be more appropriate, while the species name is still maintained. *Mycobacterium*, as a name for those organisms which in cultures may assume a more or less mycelial character, has been suggested by Lehmann and Neumann.* In this group of organisms are included the plague, glanders, diphtheria, tuberculosis, and nodule organisms, all of which have been shown to produce, under certain circumstances, branching or mycelial forms.† According to Migula's classification, the order *Mycobacteriaceæ* develops Y-shaped forms with true branchings. Neither *Rhizobium leguminosarum* nor *Vibrio (Mycobacterium) denitrificans* forms true branching of the organisms, unless we agree to call everything within a single capsule an organism, and this would be unwise. The definition requires modification to enable it to include organisms such as these which develop branching capsules. That the branching is caused by the capsules, and not by the simple organisms, can be seen from the plates which accompany this paper as well as my paper on "The Nodule Organism of the Leguminosæ."

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* Lehmann and Neumann, Diagnostik. Chester, Studies in Systematic Bacteriology; Eleventh Annual Report Delaware College Agricultural Experimental Station, 1898-99.

† Skschivan, (Plague) Centralblatt für Bakt., i. Abt., xxviii., 289. Marx, (Glanders) *ibid.* xxv., 274. Schulze, (Tuberculosis) Zeitsch. für Hygiene xxxi., 153.

EXPLANATION OF PLATE.

Vibrio (Mycobacterium) denitrificans.

Film from a 48 hours' culture in peptone-glucose-gelatine (× 1000; the enlarged marginal illustrations are diagrammatic).

OBSERVATIONS ON THE EUCALYPTS OF NEW SOUTH WALES.

PART VIII.

By Henry Deane, M.A., F.L.S., &c., and J. H. Maiden, F.L.S., &c.

E. stellulata, Sieb.; these Proceedings, 1895, p. 598.

In the highest parts of the Blue Mountains the variety *angustifolia* has the fruits sometimes in dense globular umbels.

E. coriacea, A. Cunn; these Proceedings, 1895, p. 598.

Top of Mt. Tabletop, Kiandra district (E. Betche; February, 1897). The fruits are of unusual form, being nearly hemispherical, and compressed after the fashion of *E. capitellata*, Sm. A tendency to fruits of a similar shape is shown in specimens from other elevated localities in Southern New South Wales.

E. dives, Schauer.

This is a strong species; at the same time a certain amount of variation is evident when a large series of specimens is examined. Thus the foliage may be both dull and glaucous, the fruits very shiny or very dull; they may be domed and may have the valves slightly exserted, and be more or less pear-shaped. Fruits of this sort undoubtedly show affinity to the pyriform-fruited series of *E. fastigata*.

Mr. A. Murphy, an experienced collector, says that in the Bathurst district, he distinguishes this species from *E. piperita* by the yellowish upper limbs, those of *piperita* being white.

E. FASTIGATA, Deane & Maiden.

E. vitrea, Baker, is, in our opinion, a form of the above species. The type of *E. fastigata* as figured (these Proceedings, 1896, p. 809), has smaller fruits and the valves somewhat exserted, but the size of the fruits and the amount (or absence) of exsertion varies a good deal. We have specimens from the type locality of *E. fastigata* which precisely match *E. vitrea.* So do the specimens of "Cut Tail" (W. Bäuerlen; Delegate River, May, 1889); while most of the trees from, say, Goulburn to Moss Vale and across to the Western Line about Mount Victoria are of the form figured and described by Mr. Baker. We have from Jenolan Caves a form even more aberrant than that Mr. Baker describes. It would be readily taken for a narrow-leaved form of *E. coriacea* from herbarium specimens alone. Beyond the Blue Mountains the trees of *E. fastigata* more closely approximate to the type, and are sometimes of enormous size.

Pyriform series.—The type of *E. fastigata* has fruits somewhat pyriform, but some trees have this character accentuated. We can, however, scarcely call this a variety. The rims of the fruits may be slightly sunk, horizontal, or even domed, with the valves slightly protruding. The red mouth or rim shows resemblance to *E. hæmastoma.* We have what we may term small pyriform fruits. Our specimens all come from northern parts of the Colony, *e.g.*, Upper Williams River, Cobark and the Gloucester district generally. See figs. 5 and 6, pl. lvii. of these Proceedings, 1895, under *E. amygdalina*, var. (*E. dives*). Fruits of a "Peppermint" from The Valley, near Springwood, Blue Mountains, collected by us in April, 1888, are pyriform of intermediate size.

Following have large pyriform fruits :—

(*a*). Wingello (J. L. Boorman; November, 1899). Collector's note.—"Bark rough, soft, from base up to tips of branches, grey in colour. Leaves not so large as those of *E. Sieberiana*, and the bark differing both in texture and colour. The wood soft, ringy and generally inferior. Known locally as 'Messmate.'"

(*b*). "Peppermint" or "White Mahogany." Burriel, near Milton; also Pigeon-house Mountain to within 100 feet of top (R. H. Cambage; December, 1899). Has grey, rough bark.

(*c*). Top of Penang Ranges, 8 miles from Gosford (A. Murphy; February, 1900). Very like a Peppermint in appearance, only the bark is not so stringy,—more flaky. White, smooth limbs.

Nos. (*b*) and (*c*) were referred to provisionally as *E. stricta*, var., in these Proceedings, 1900, p. 109.

We take this opportunity of pointing out the considerable amount of variation that occurs in Eucalypts of the Series *Renantheræ*. Thus *E. delegatensis*, Baker, and *E. vitrea*, Baker, possess affinities, on the one hand, with *E. obliqua* and *E. Sieberiana*, while on the other hand they show affinity with what may be termed the Peppermint group, consisting of *E. fastigata*, Deane & Maiden, *E. regnans*, F.v.M., *E. amygdalina*, Labill., and *E. dives*, Schauer, which are connected in a number of ways.

E. OBLIQUA, L'Hérit.

Head of the Gwydir, Leichhardt, 1843. In leaf only, but there is no doubt as to the identity of the plant.

E. VIRGATA, Sieb., var. ALTIOR, Deane & Maiden.

E. oreades, Baker (these Proceedings, 1900, p. 596), is this variety. Precisely the same form occurs in Tasmania and Victoria. At an elevation of about 1,000 feet in Tasmania it commonly occurs with bark smooth from the base and with all degrees of fibrous bark. In *E. oreades*, Baker, the fruits are immature, and those from Victoria and Tasmania pass through a precisely similar stage.

E. MUELLERIANA, Howitt; these Proceedings, 1898, figs. 9-11 of Pl. xxx., under *E. pilularis;* 1899, p. 460.

We have already stated our opinion that *E. dextropinea*, Baker, is this species. We find that *E. lævopinea*, Baker (these Proceedings, 1898, p. 414), is specifically identical with *E. dextropinea*, and consequently with *E. Muelleriana*.

Mr. Jesse Gregson has sent us the species from Warrah, Great Northern Line. It also occurs in the Tenterfield district, Great Dividing Range, and we have now traced it in different localities from the Queensland to the Victorian border. How far west it occurs is a matter for enquiry. It is the *E. pilularis*, with "rims rather broad," of Bentham, and has commonly been confused with that species.

We have received from Mr. A. H. S. Lucas a "Stringybark" from the Kanimbla Valley, March, 1900. It has fruits smaller than those of the type.

E. Muelleriana extends into north-western Victoria. We have received from Mr. J. G. Luehmann two specimens from the Wimmera which were formerly referred to *E. capitellata.*

E. HÆMASTOMA, Sm.

We draw attention to a shrubby form of this species, only 2-3 feet high as seen, from Mount Victoria. The fruits are in heads (it is worthy of note that other species, *e.g.*, *eugenioides*, *stellulata*, tend to assume capitate-fruited forms in cold mountain localities), and undoubtedly a very extreme form of var. *micrantha*, and we propose for it the name var. *montana.*

E. SIEBERIANA, F.v.M.

Trees called (*inter alia*) "Gum-topped Stringybark," from Lake Sorell, Tasmania, Mount St. Bernard and other alpine localities in Victoria, the Mount Kosciusko Range in New South Wales, "Messmate," at Mount Baw Baw, Victoria, and widely distributed in alpine situations in the three colonies, were in years gone by labelled by Mueller *E. obliqua* and finally *E. Sieberiana.* One of us recognised the tree without hesitation, in the field, as *E. Sieberiana* (Victorian Naturalist, 1900, p. 46, vol. xvii.), and there is no doubt as to the correctness of this view, in our opinion. The tree has recently been described in these Proceedings (1900, p. 305) by Mr. R. T. Baker as *E. delegatensis*, which we think regrettable. Examination of *E. Sieberiana* in the field over large areas shows how variable this species is as regards its bark, glaucousness of its fruit and foliage, shape of its fruit, and thinness and oil-content of its leaves.

E. FASCICULOSA, F.v.M.

This is, in our opinion, *E. intertexta*, Baker (these Proceedings, 1900, p. 308).

E. BOSISTOANA, F.v.M.; these Proceedings, 1900, p. 112.

It is worthy of note that the immature fruits of this species have a marked outer rim such as is a prominent character in *E. melliodora.*

E. CORDATA, Labill.

Rockley Road, near Bathurst (R. H. Cambage; February, 1900). This species is new for the Colony, having hitherto been only recorded from Tasmania. The leaves of *E. cordata* are more coriaceous and less acute than those of *E. pulverulenta* of similar age.

E. LONGIFOLIA, Link & Otto.

Raymond Terrace, north of the Hunter River (Augustus Rudder). This is the most northerly locality known to us.

E. GONIOCALYX, F.v.M.

Tia, New England (W. Forsyth; October, 1900). This is the first northern locality recorded for this species.

E. QUADRANGULATA, Deane & Maiden; these Proceedings, 1900, p. 110.

"White Box," Bundanoon (J. L. Boorman; June, 1900). "Exceedingly tall trees growing in the gorge around this district to the depth of from 800-1,000 feet from the level of the surrounding country; 80-100 feet high, stems 3-4 feet in diameter; bark grey, suberous, slightly ribbony at tips of branches; the sap-wood yellow, centre red, darkening with age, interlocked in grain;

fruits tubular, valves decidedly valvate, arranged (mostly) in threes; suckers glaucous, stems round, slightly angled. Used largely for sleepers " (Collector's note).

E. RESINIFERA, Sm.

A.—*Normal or small-fruited form.*

We have this form as far south as Conjola, near Milton. It is not rare in the Sydney district, *e.g.*, Hunter's Hill, Eastwood, Hornsby, Blaxland, Homebush, Cabramatta, Bankstown, Cook's River. It was much more plentiful in this district at one time, but it has been largely cut out, since it yields one of the most valuable of our timbers. Westerly it is less developed; it occurs at least as far as Springwood, Blue Mountains (form with sessile flowers). It attains its best development in the North Coast district, and it is more or less plentiful from Port Jackson to Queensland.

From the Bargo River, Picton district, we have specimens with very narrow leaves. From Cabramatta, and thence northerly to Bulladeelah, and thence to the Tweed, we have a rather common form with a very long subulate operculum, longer even than that of *E. tereticornis*, except in its extreme forms. This form we observe at Maroochie in Queensland.

From near Thirlmere we have a form with fruits of medium size, hemispherical, and the valves but little exserted. We have a smaller-fruited form, hemispherical, and the valves even less exserted, from Auburn and Oatley, both in the Sydney district, south of Port Jackson.

Specimens from Cabramatta show the broadening rim as large in comparison, considering the size of the fruit, as it is in some of the *grandiflora* forms. All these differences amount to but little, for the small-fruited form of *E. resinifera* is really very constant.

B.—*Large-fruited forms.*

Much more variation is undoubtedly presented by *E. resinifera* in its large-fruited than in its small-fruited forms.

1.—Var. *grandiflora*, Benth., B.Fl. iii. 246.

This variety includes *E. pellita*, F.v.M., and *E. spectabilis*, F.v.M., and a series of closely allied forms bearing very near affinity to *E. resinifera*. They are all known as Mahogany, and have the wood and bark of *E. resinifera*. Some of the forms are described with a little detail :—

(*a*) Buds ovoid to a "long beak and gradually tapering" (all connecting forms). Fruit about 7 lines in diameter, with rather broad, raised rim and exserted valves.

This is the typical var. *grandiflora* referred to by Bentham, who points out its probable affinity to *E. pellita*, F.v.M.; and Baron von Mueller has (Eucalyptographia) himself merged *E. pellita* in *E. resinifera*.

Besides Manly (the B.Fl. locality for this variety), it occurs as far south as Conjola, near Milton (W. Heron), and Currawang Creek (W. Bäuerlen), which are the most southerly localities hitherto recorded, while Springwood, Blue Mountains (J. H. Camfield), with narrower rim and valves less exserted, is the most westerly locality known to us.

(*b*) Buds not seen. Very broad rim round fruit. Fruits very large (10 lines diam.). Ordinary "Forest Mahogany" bark and timber. "Mountain Mahogany" (Olney, F. R.), Cooranbong; also Wyong.

Clarendon Stuart's No. 486, Timbarra, near Tenterfield, has a fruit precisely similar to the preceding, though smaller. It bears Mueller's MS. name "*E. resinifera*, Sm., var. *brachycorys*."

2.—Var. *Kirtoniana*, var.nov.

(Syn. *E. Kirtoniana*, F.v.M., in Eucalyptographia, Arts. *E. resinifera* and *E. robusta; E. patentinervis*, R. T. Baker, these Proceedings, 1899, p. 602).

Buds all with a long beak and gradually tapering. Fruits about 5 lines diameter. Valves usually *very* exserted. Tendency to conical (when dry), but also subcylindrical. Tendency to twinning in the fruits. Rather narrow rim.

Illawarra (Kirton); Concord, Parramatta River (Rev. Dr. Woolls); Cooranbong (J. Martin); Bungwall (A. Rudder); Port Macquarie (G. R Brown); Ballina (W. Bäuerlen).

In 1879 Mueller wrote of this tree as follows ("Eucalyptographia," under *E. resinifera*) :—

" In the Illawarra district occurs a tree which attracted great attention in India* . . . It was there considered to belong to *E. resinifera*. It differs, however, from that species in having the leaves of equal colour on both sides with more prominent veins, the intramarginal veins more distant from the edge; thus in venation, as also in odour of foliage and fruit, the tree in question approaches *E. robusta*, but its fruit is certainly similar to that of *E. resinifera*, wanting, however, the broadish outer ring around its orifice, characteristic of the typical *E. resinifera*, while the lateral veins of the leaves are not quite so transversely spreading as in either. If really specifically distinct, the tree might be named *E. Kirtoniana* in honour of its discoverer."

In 1889 the late Rev. Dr. Woolls first drew our attention to this plant,—a fine tree growing at Concord, near the Parramatta River. He looked upon it as a possible hybrid between *E. resinifera* and *E. robusta*. The fruits are sub-cylindrical and the valves not much exserted even when quite ripe, the likeness to those of *E. robusta* being thus evident. Its bark is harder than that of normal *resinifera*, and the venation precisely that of *E. Kirtoniana* and *patentinervis*.

In 1893 Mr. W. Bäuerlen, then, as now, collector to the Technological Museum, specially brought the same form from Ballina under the notice of one of us on several occasions. We investigated the plant, made full notes in regard to it, and then, as now, considered it a form of *E. resinifera*. Mr. R. T. Baker takes a different view, and figures and describes the plant under the name of *E. patentinervis* (these Proceedings, 1899, p. 602).

Mr. Bäuerlen drew attention to the fact that the Eucalypt in question did not agree with the figure of *E. resinifera*, Sm., of the "Eucalyptographia," particularly in the venation and in the anthers. Of the venation we will speak presently; the idea that the anthers are dissimilar is founded on a misapprehension. He said, "In every respect I think it approaches nearer to *E. rudis*,"—a view, we observe, which is to some extent adopted by Mr. Baker. We consider this suggested affinity to *E. rudis* ingenious, but unnecessary. Mr. Bäuerlen also drew attention to the fact that the oil-dots in his specimen are not "largely pellucid." Our notes, however, made when the leaves were quite fresh, state "oil-dots very copious, translucent;" the matter is of secondary importance. We have a note in regard to Mr. Bäuerlen's specimen, "timber and bark agree well with *E. resinifera*." This tree came from a dry sandy hill near the sea-shore, an unusual situation for the species; it is not a matter for surprise that it is aberrant.

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* It is also cultivated in South Australia.

The fruit-rim, while often flat, is not always so, being sometimes domed, connecting it, in this respect, with other forms of *E. resinifera*.

Mr. Bäuerlen's principal point was in regard to the venation of the leaves, and his specimens certainly do differ in this respect from those of some specimens of *E. resinifera*. But on looking at the matter a little closer, we find that this point has already been brought under notice by Mueller in regard to *E. Kirtoniana*. Then, again, it is a mistake to suppose that the fine transverse veining we are accustomed to look for in *E. resinifera* is an invariable characteristic of that species. In leaves of the following, for example, the venation is not in any way different from the so-called *Kirtoniana* or *patentinervis*:—

1. *E. resinifera*, Cabramatta.
2. A very small-fruited *resinifera* from Auburn, near Parramatta.
3. A specimen of *E. resinifera*, No. 10, from the Port Stephens district (A. Rudder).
4. A large-fruited *E. resinifera* from Springwood.

Leaves of these specimens absolutely match the *tereticornis*-like that of normal *resinifera*. The transition is as absolute in regard to venation as it is in regard to fruits or opercula. The long operculum of the variety is equalled and even exceeded by some specimens belonging to normal *resinifera*. The specimens from the Richmond to the Hawkesbury are absolutely identical, the Illawarra and Parramatta River specimens exhibiting a little difference from Mr. Baker's figure, as already indicated.

The fruits of this variety occasionally show twinning, which is unusual in Eucalypts. We have specimens from normal *resinifera* from the Sydney district which also show twinning, and in shape are simply reduced models of those in Mr. Baker's figure.

Mr. Rudder's Bungwall specimens were sent to one of us in 1894, and our re-examination of the plant, and correspondence with Mr. Rudder at the time, convinced us that it could not be separated from *E. resinifera*. The Rev. Dr. Woolls labelled similar specimens from Mr. Rudder *E. resinifera*, var. These specimens from Mr. Rudder and Mr. Bäuerlen's Ballina specimens are Mr. Baker's types of *E. patentinervis*.

E. PUNCTATA, DC.; these Proceedings, 1900, p. 113.

We offer some notes on this species, which is undoubtedly very close to *E. resinifera*

1.—*Normal or small-fruited form.*

This is one of the species on which one does not often observe young suckers. The leaves are ovate and the stems quadrangular in the young state.

Following are some notes on *E. punctata*, but although we have endeavoured to classify them into three forms for convenience there is no real difference between them, as they are all easily run into each other :—

(*a*). Operculum intermediate between blunt form and the typical *resinifera*. Fruits hemispherical to sub-cylindrical, diameter 3 or 4 lines; valves exserted. Rim between calyx and operculum often forming a sharply defined edge.

South as far as Goulburn district; north to the Richmond River; west as far as Jenolan Caves, Capertee, and Rylstone. In the northern forms the rim is often flatter, *i.e.*, less domed; near Mittagong the valves are unusually well exserted, but there does not appear to be much variation.

This form (except perhaps as regards the fruits, whose valves are quite exserted) is figured by Baron von Mueller in the Eucalyptographia, and it is very near the type, although it differs from De Candolle's original description in the following points, not perhaps of much importance (*note*, fruits not described):—

(*a*). Lid of calyx *not* longer than the cupula.

We have a small specimen of Sieber's No. 623 (on which DC.'s description was based) before us. As a rule the lid of the calyx is a little longer than the cupula (calyx-tube), but not much, and it varies. It is a small form of *E. punctata.*

(*b*). Nerve (*e.g.*, in the Wallsend specimens) sometimes quite marginal.

(2). Blunt, nearly hemispherical operculum, and largish fruits. Very thick, leathery leaves.

Manly Beach (Swamps). In these specimens the valves are not much exserted. We have precisely similar specimens, except that the operculum is very pointed, from the Woniora River.

(3). Sub-cylindrical fruits, drying green (?). Valves scarcely exserted. Rather long, conical operculum. Cook's River.

The fruits are precisely those figured for *punctata* in the Eucalyptographia, except that the tops of those in the figure are hardly so convex, and the valves should be shown more convex. The fruits figured are not ripe.

Our specimens referred to above satisfy De Candolle's description excellently, except in one little point—the operculum *is* a little constricted in buds fully ripe. Perhaps the original description was penned from buds less far advanced.

2.—*Large-fruited forms.*

E. punctata, DC., var. *grandiflora*, var.nov.

Leaves punctate. Buds all ovoid. Double operculum. Rim at junction of calyx and operculum very sharp. Calyx-tube usually angled. Fruits 7 to 8 lines in diameter; valves usually not much exserted.

We have an intermediate form (from Wyee) with valves well exserted.

Shape hemispherical, or nearly so, to conoid. Rather broad rim. Bark and timber not to be distinguished from that of normal *punctata*.

This large-fruited form is well marked, and well worthy of being a named variety. As in *resinifera*, so in *punctata*, there is no line of demarcation between the normal and *grandiflora* forms, the transition being gradual.

Comparing this with the normal or small-fruited form, Mr. Augustus Rudder, a forester of considerable experience, writes in the *Agricultural Gazette* :—" This is one of two trees with the same vernacular (Grey Gum). In general appearance, to the casual observer, the trees are much alike, but the leaves of this are rather broader, and its fruits and blossoms are very much larger than those of the other variety, and the trees generally are not so large, and are more limited in range of habitat, and, as a rule, do not approach so near to the coast, though I have seen it at Raymond Terrace, and near the beach at Charlotte Bay and Wallis Lake in this district; the two trees often grow together. I have mostly observed it on the lower ranges in the counties of Gloucester and Durham. The timber is red in colour, is hard, and very lasting, and is well suited in the round, for heavy timbers in bridges and culverts."

We have collected it within the range stated. Hitherto this form has only been found north of Port Jackson.

This tree has been frequently confused with the *grandiflora* form of *E. resinifera*, where herbarium specimens only are available; in the forest the two trees could not be confused for a moment, their bark immediately distinguishing them. The smooth bark often of a yellow ochre or pale brown colour; hence might be called "Brown-barked Gum." It is known in the Mudgee district as "Slaty Gum," as well as "Black Box," both descriptive names for certain trees.. The buds also are very different, those of the variety of *punctata* being ovoid,* and the rim very sharp, with frequently a double operculum, those of the variety of *resinifera* being conical and even rostrate.

The fruits of the variety of *resinifera* have the valves more exserted, and they sometimes have a tendency to be conical.

E. TERMINALIS, F.v.M.

Warialda (H. Deane; May, 1900). The most easterly locality in the colony from which we have obtained this species. Fruits very large.

E. GUNNII, Hook. f.; these Proceedings, 1889, p. 464.

We will allude at length to this species in our remarks under *E. viminalis*. We add some notes on *E. Gunnii*.

Hooker, the author of the species, speaks of it (Fl. Tas.) as "a very common, but singularly variable small tree." No species of Eucalyptus known to us is more variable; we will endeavour to make clear some of the various forms it assumes.

Considerable confusion has arisen in regard to *E. Gunnii* and *E. Stuartiana* in early sendings from Australia and Tasmania, as some forms in bud only are extremely difficult to discriminate.

The confusion has even extended to *viminalis* (see remarks on p. 137 *a*).

There need be no further necessity for confusion if the synonymy given in this paper (the outcome, in part, of personal examinations of the Melbourne and principal European herbaria) be noted.

We would invite attention to a tree, "Hickory" (Lockhart Morton), from Twofold Bay. "One of the largest trees of these parts" is *E. Gunnii*. Bentham's label is *E. viminalis*, var., and it has been variously labelled by eminent botanists *viminalis*, *saligna*, *Gunnii*, and *Stuartiana*, an excellent commentary on the difficulty of dealing with some species of Eucalyptus when only imperfect material (as in this case) is available.

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* The bud reminds one of an egg in an egg-cup.

Broad suckers, usually (perhaps always) more or less glaucous. In dried specimens this glaucous appearance often disappears.

E. Gunnii is one of the most widely diffused species. It is very abundant in Tasmania, Victoria and New South Wales, and by no means rare in South Australia and Queensland, though we cannot yet state to what extent it is diffused in those two colonies. The "Yellow Gum" of St. Vincent's Gulf, South Australia, we believe to be a form of *E. Gunnii*. In our own colony, amongst other localities, it is common at Mount Victoria, is widely diffused in New England, the buds being often ovoid, often very multiflowered, and the venation very marked. We have specimens collected on the Gwydir by Leichhardt, with very broad leaves, and Mrs. Hodgkinson (Herb. Melb.) collected it on the Richmond River.

In our opinion the species includes the following more or less marked varieties:—

1. Var. *glauca* (syn. *E. Perriniana*, F.v.M.).
2. Var. *acervula* (syn. *E. acervula*, Miq.; *E. paludosa*, Baker).
3. Var. *ovata* (syn. *E. ovata*, Labill. partly; *E. camphora*, Baker).

There may be other forms of the species.

E. GUNNII, Hook. f., var. GLAUCA, Deane & Maiden; these Proceedings, 1899, p. 464.

This is identical with *E. Perriniana*, F.v.M., which is really a "very luxuriant young growth of *E. Gunnii* that maintains the juvenile foliage till many (12-15) feet high, bearing flowers in the upper axils; from this the leaves become alternate and all members typically *E. Gunnii*. It is most interesting that in the young state it is indistinguishable from *E. pulverulenta*" (Rodway). *E. Perriniana* was named from Tasmanian plants, and we are indebted to Mr. L. Rodway for an excellent series.

E. GUNNII, Hook. f., var. ACERVULA, var.nov.

(Syn. *E. acervula*, Miq.; also *E. paludosa*, Baker, these Proceedings, 1899, p. 464).

This is *E. acervula*, Miq., according to specimens in European herbaria. We have found it as far north as Hill Top. It was called "Yellow Gum" on a label by the late Rev. Dr. Woolls over 40 years ago. It has a yellowish sap-wood, and the buds and general cast of the foliage are often yellow. It is also called "Creek Gum." "Yellow Gum" is the district name (Goulburn to Moss Vale) for *rubida* also.

E. GUNNII, Hook. f., var. OVATA, var.nov.

(Syn. *E. ovata*, Labill. partly; *E. paludosa*, Baker).

There is a form of *E. Gunnii* found in Tasmania, Victoria and New South Wales, usually in cold and low-lying situations. It is not a large tree, and is usually known as "Swamp Gum" and "Flooded Gum," but also as "Broad-leaved Sally." The leaves are often broad, and sometimes mucronate. Typical and conical-fruited *Gunnii* from both Tasmania and Victoria are, however, not rarely mucronate also. The operculum is often beaked, and the fruits are small, conoid, and with very exserted valves. There exists, however, an absolutely complete series of specimens of *E. Gunnii* fruits from hemispherical to conical, and with sunken valves to those extremely protruded. We have had these extreme forms under observation for many years, and continue to hold the opinion that it is impossible to separate them from *E. Gunnii*. Mr. R. T. Baker has figured and described an extreme form (which we have for many years noted in MS. as *E. Gunnii*, Form 3) in these Proceedings (1899, p. 298) under the name of *E. camphora*, and further field experience only establishes our conviction that it is but a variety of *E. Gunnii*. The tree is very common in North-Eastern Victoria, and was always labelled "*E. Gunnii*" by Mueller.

We have *E. Gunnii* from the Jenolan Caves, with typical fruits and leaves even broader than those of Mr. Baker's *camphora*.

It is identical with the *E. ovata*, Labill., of European herbaria. Labillardière's figure is very crude, but the specimens preserved are identical with Mr. Baker's *E. camphora*, or one of the many forms connecting it with *E. acervula*, Miq., (Mr. Baker's *E. paludosa*).

E. VIMINALIS, Labill.

The typical tree is usually called "Manna Gum," but often "White Gum." Peduncles three-flowered. Bark smooth, deciduous, hanging in strips. Leaves of suckers narrow, opposite, glabrous. The species is, however, very variable, as we will indicate in detail.

Seedling leaves.—Usually they are narrow, but they vary a good deal in size and texture, becoming almost coriaceous in some

leaves we take a

CORRIGENDUM.

Page 136, line 13—For *E. paludosa*, read *E. camphora*.

It must,

it is comparative as regards the usual narrow sucker-leaves of *E. viminalis*, and that it is far from approximating to broad suckers, *i.e.*, those in which length and breadth tend to become equal.

Mature leaves.—The strictly opposite character of the seedling leaves sometimes extends even to the mature foliage. We have seen leaves taken from the tops of trees growing near Melbourne by Mr. J. G. Luehmann still strictly opposite.

In this species width, length, texture and shininess are no absolute criterion, as they all vary. See notes on "buds." The foliage of typical *viminalis* is precisely similar to that of the multiflowered group.

Pedicels.—Pedicels short (B.Fl.). They, however, vary in length in many localities.

Buds.—In New South Wales specimens the buds are usually very smooth and shining (B.Fl.). The words "smooth and shining" apply best to the buds of certain forms of *E. Gunnii* that Bentham included under *viminalis*, but shininess is no absolute criterion.

Operculum.—"Conical or hemispherical, blunt or sharp, as long as the calyx" (Hooker's Fl. Tas.). Obtuse or conical, not much longer than the calyx-tube (B.Fl.). The shape varies within very wide limits. The ovoid-budded forms have the opercula rounded, sometimes nearly hemispherical; others are conical and even beaked. In Northern New South Wales, for example, the operculum varies from ovoid to very pointed; this latter form is found in the northern portion and in Victoria and Tasmania. The beaked operculum is found in the three-flowered and multiflowered series.

Following are notes on two specimens with beaked or very long opercula:—

(*a*) A specimen from Snowy River in Herb. Melb. in Mueller's handwriting "*E. viminalis*, Labill., var. *pedicellaris*, Mueller." Slightly glaucous; multiflowered. (This is Mr. Baker's *E. Smithii*).

(*b*) Also from the Snowy River, labelled by Mueller "*E. viminalis*, Labill., var. *rhynchocorys*, Ferd. Mueller (*rhynchos*, a beak) and with the addition, "Regarded by Bentham as a variety of *E. tereticornis*" (a mistake readily made with specimens only in leaf and bud). Three-flowered; slightly glaucous.

E. viminalis often multiflowered.

"Peduncles . . . bearing three, rarely four or more flowers. . . . Australian specimens have often more than three flowers on each peduncle" (Hooker's Fl. Tas.). We have a number of multiflowered specimens from Tasmania.

"Peduncles short, axillary or lateral, bearing in some specimens, especially northern ones, always 3 flowers on short pedicels, in others 6 to 8 flowers more distinctly pedicellate" (B.Fl. iii. 239).

"The species varies very much in the size and number of the flowers, and the shape of the operculum. In the original Tasmanian form, common also in Victoria, the peduncles are mostly 3-flowered, although occasionally many-flowered specimens occur" (*ib.*, p. 240).

E. mannifera, Moodie, MSS., in Trans. Med. Bot. Soc. iii., 24 (Walpers, Repert. ii., 163) "4-6 floris." This is stated by Bentham to be *E. viminalis*.

E. persicifolia, Lodd., (Bot. Cab. t. 501) referred by Bentham to *E. viminalis*, is multiflowered.

Howitt's "typical form of *E. viminalis*" ("Eucalypts of Gippsland," Trans. R. Soc. Vict. ii., Part i. p. 97, pl. 15, figs. 23-31), includes a form with 5 flowers.

"Umbels generally three-flowered" (Mueller, Eucalyptographia).

"*E. viminalis* rarius 4-7 floris" (Fragm. ii. 64).

We have Hartmann's specimens No. 511 from the Condamine, Queensland, before us. They absolutely match many Victorian *viminalis* specimens, except that they are multiflowered. Mueller labelled them *viminalis*, and Bentham concurred. The species in Northern New South Wales and Queensland is usually, but not always, multiflowered.

At Lidsdale we found trees of the true "Manna or Weeping White Gum," flowers mostly in threes but up to 7's; and in the Kanimbla Valley (road to Lowther) with flowers in 4's.

We have often amused ourselves in searching for 4's and even for 5's in trees that appeared to have the inflorescence entirely in 3's, and usually found them, if sufficient patience be exercised. The variety known as *pedicellaris* is normally multiflowered, but the number of flowers varies.

It is often convenient in practice to divide the species into those which have the flowers in threes and those which have them in more than three. We have multiflowered specimens from every colony in which the species is found.

The word *multiflora* may be used as a convenient term to describe the forms of *viminalis* (otherwise closely related to the

Manna Gum), which have the flowers in more than three (as well as in threes).

E. viminalis has been sent to us with red flowers from Mt. Wilson by Mr. Jesse Gregson.

Fruits.—"Fruit-rim not very convex and often flat. In the New South Wales specimens the flowers and fruits are usually small" (B.Fl.). The size and shape of the fruits vary a good deal. We have some quite small ones from Tasmania, and the largest ones we have ever seen are from Northern New South Wales. From that part of the colony we have also obtained some smaller than the average, and some with valves protruding further than we have seen from any other locality. Sometimes they are nearly hemispherical; others are longer in proportion to the width.

Bark.— . . "With a rough persistent bark, at least on the trunk and main branches, that of the smaller branches often smooth and deciduous, and sometimes the whole described as deciduous." . . . "In New South Wales specimens the bark sometimes said to be quite smooth, probably when the rough bark has been shed" (B.Fl. iii., 239, 240).

"Bark much persistent on the stem and sometimes also on the main branches, outside rather dark coloured, wrinkled and rough, comparatively solid in texture, though somewhat fragile; through secession leaving the younger bark outside smooth and whitish-grey or almost white, giving off externally, when rubbed, a flour-like bloom, as does also the bark of *E. redunca*" (Eucalyptographia).

"Bark rather solid, extensively deciduous" (Mueller, Key Victorian Plants).

"*E. viminalis* at Wando Vale locally called Blackbutt; bark very rugged and persistent up to the small branches" (A. W. Howitt).

Some specimens from the Grampians, Victoria, bear, in Mueller's handwriting, the words "Rough bark, *not* fibrous bark."

The last two specimens are multiflowered. and are identical with Mr. Baker's *E. Smithii*.

The typical *E. viminalis*, as we know it in New South Wales, is a "Ribbony Gum." The ribbons are best seen on wet, windy days; they then flatten out and are seen to be of great length, like streamers or pennants. In Tasmania (the species was described from Tasmanian specimens), Victoria and Southern New South Wales, the bark is, however, often very rough. We have both in Southern and Western New South Wales and Southern Victoria seen the whole trunk encased in hard, black bark, giving the tree, at first sight, almost the appearance of an Ironbark. Mr. Baker's *E. Smithii* is a rough-barked tree of this kind. It must be distinctly understood that multiflowered *viminalis* has not always a rough bark, *e.g.*, the "White Gum" of Beilsdown Creek and other parts of New England and South Queensland.

The lower part of the stem of *viminalis* has hard, black bark. In var. *pedicellaris* the bark is higher up the stem than usual. *E. saligna* is another species in which the height of the rough bark varies.

Timber.—"Said to be durable" (A. W. Howitt, of a rough-barked Wando Vale specimen). We have for some years heard a favourable report of a timber in Southern New South Wales from the same locality as Mr. Baker's *E. Smithii*, and identical with it. We invite attention to the observations, by one of us, as to the durability of *E. viminalis* timber in the Dorrigo Forest Reserve (Agric. Gaz. N.S.W. v. 612, 1894). The timber of *E. viminalis* is usually so inferior that it will surprise many people to hear it spoken of in terms of praise; at the same time the best of it is far from being a first-class timber. We require further evidence in regard to its quality.

VARIETIES.

Var. 1. E. VIMINALIS, Labill., var. PEDICELLARIS, F.v.M. (*ined.*).

Mr. R. T. Baker has described a species (these Proceedings, 1898, p. 292), under the name of *E. Smithii* which, in our opinion, is simply a variety of *E. viminalis* with 6-8 flowers and longish pedicels. It is the *E. viminalis* var. *pedicellaris*, F.v.M., of Herb. Melb. It has rough bark at butt, and notes in regard to it will be found under "Bark" (*supra*, p. 140). It has narrow suckers like normal *viminalis*.

At Ben Bullen there is a clump of trees growing in a low-lying situation. The timber, bark, foliage and habit are identical, with the exception that the rough bark of var. *pedicellaris* is further up the stem than is the case with the *viminalis* alongside ; it is, of course, multiflowered. The trees are all 2-3 feet in diameter, and as regards the rough bark, it varies from three feet to ten feet up the butt in normal *viminalis*, and from 12 or 15 feet up to the first fork and even beyond in var. *pedicellaris*. The most careful examination fails to show any difference in the texture of the rough bark of *E. viminalis* and its variety *pedicellaris*.

Mr. Smith has shown that the leaves of this variety are much richer in eucalyptol than those of the normal form.

Var. 2. E. VIMINALIS, var. BAEUERLENI, var.nov. (syn. *E. Baeuerleni*, F.v.M. (Victorian Naturalist, October, 1890).

This plant is, in our opinion, a large-fruited form of *E. viminalis*. The seedling leaves partake of the character of those of normal *viminalis*. The leaves in no way differ from those of *E. viminalis*. The operculum shows a peculiar shrunken appearance, more often noticed in *E. Gunnii* than in *E. viminalis*. The calyx at its junction with the operculum expands to form a rim; this is, however, a character which is but an exaggeration of what is sometimes seen in normal *viminalis*. The fruits are very large and in threes. We retain the name *Baeuerleni* for this variety.

Amidst all the variations existing in E *viminalis*, it seems, perhaps, inexpedient to make an additional variety of the following, but we draw attention to a very narrow-leaved (nearly linear) form. It includes (1) Clarendon Stuart's No. 129; "bark very smooth and white"; New England; venation well marked; buds pointed; in threes and fours in our specimens, named *viminalis* by Bentham. (2) "Silver-top"; bark persistent to 20-30 feet up; smooth bark bluish; Mountain Top, Nimitybelle (W. Bäuerlen); flowers in threes. (3) Similar to (2) except that the veins of (3)

SUMMARY.

E. viminalis, Labill.

Three-flowered:—

a. With large fruits: var. *Baeuerleni* (*E. Baeuerleni*, F.v.M.)

Multi-flowered:—

b. Generally with long pedicels and very rough bark: var. *pedicellaris*, F.v.M (*E. Smithii*, Baker).

c. Form with linear leaves for which we propose no variety name.

E. GUNNII AND E. VIMINALIS.

With all the varying forms of these two species, they fall naturally into two series, those with broad suckers (*E. Gunnii*) and those with narrow suckers (*E. viminalis*). It is quite true that the width of the suckers varies in some forms, but never to such an extent as to render it really doubtful to what species a given form belongs.

E. viminalis, *E. Gunnii* and its varieties may all have ribbony, scaly, and even hard black bark (in exceptional cases) up to first fork and beyond. In the present state of our knowledge we are unable to discriminate between the various kinds of timbers belonging to the two species.

The affinity of *E. viminalis*, Labill., is undoubtedly very close with *E. Gunnii*, Hook. f. We go so far as to say that in the present state of our knowledge, unless fruits or suckers be available, it is not always possible to say whether a certain tree is *E viminalis* or *E. Gunnii*. This more particularly applies to certain trees in Western and Northern New South Wales, at great distances from the home of the typical forms.

But while indicating that in our opinion there is no absolute line of demarcation between *E. viminalis* and *E. Gunnii*, we would observe that it can be said of many other species of Eucalyptus that they are closely related to congeners. *E. viminalis* and *E. Gunnii* both include large numbers of trees with smooth bark; the fruits of the former are often in more than threes; those of *E. Gunnii* are usually more than three. The

Mr. Maiden exhibited numerous herbarium specimens in illustration of the papers contributed by Messrs. Betche, Deane and himself.

Mr. R. T. Baker exhibited an aboriginal stone axe reputed to have been found at a depth of 25 feet while sluicing for gold at the head of Tumberumba Creek. The specimen is a large and very fine one, of modern pattern and without any indication that high antiquity can be claimed for it. It has been presented by the finder, Mr. Heinecke, to the Albury Museum.

Mr. R. Greig Smith exhibited a series of cultures and specimens in illustration of his papers.

Mr. Froggatt exhibited specimens of remarkable galls on Myall (*Acacia pendula*) from Tamworth, due to the attacks of a species of Thrips.

On the invitation of the President, Mr. Coleman Phillips, a visitor, addressed the Meeting on the subject of rabbit extermination. The speaker, a resident of South Wairarapa, New Zealand, explained that in his district rabbits were successfully kept in check by the operation of introduced natural enemies (ferrets, stoats, and weasels), and the spread of diseases (bladder-worm, liver-rot, scab, and lice).* Trapping, fumigation with bisulphide of carbon, or reliance solely upon poisoning or wire-netting, he considered to be altogether wrong. He advocated in preference those measures which had been successfully tried in New Zealand; and at the same time he expressed his astonishment that in Australia anything like organised effort of the right kind in dealing with so important a matter seemed conspicuously absent.

Discussion followed.

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* The speaker's views are explained at length in Trans. N. Zealand Inst. Vols. xxi. p. 429, and xxii. p. 308. Also in the Progress Report, &c., of the Royal Commission of Inquiry into Schemes for Extermination of Rabbits in Australasia, p. 115 (Sydney, 1890).

WEDNESDAY, MAY 29TH, 1901.

The Ordinary Monthly Meeting of the Society was held in the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, May 29th, 1901.

Mr. J. H. Maiden, F.L.S., &c., President, in the Chair.

Messrs. J. H. **CAMPBELL**, Royal Mint, Sydney; **ALEX. BORTHWICK**, Botany Road, Alexandria; **HENRY GULLETT**, Wahroonga; and H. L. **KESTEVEN**, Australian Museum, Sydney, were elected Members of the Society.

DONATIONS.

Department of Agriculture, Brisbane—Queensland Agricultural Journal. Vol. viii. Part 5 (May, 1901). *From the Secretary for Agriculture.*

Royal Society of Queensland, Brisbane—Proceedings. Vol. xvi. (1900). *From the Society.*

Australian Museum, Sydney—Report of the Trustees for the Year 1899. *From the Trustees.*

Department of Mines and Agriculture, Sydney—Agricultural Gazette of New South Wales. Vol. xii. Part 5 (May, 1901). *From the Hon. the Minister for Mines and Agriculture.*

Royal Anthropological Society of Australasia, Sydney—Science of Man. Vol. iv. n.s. Nos. 3-4 (April-May, 1901). *From the Society.*

Australasian Journal of Pharmacy, Melbourne. Vol. xvi. No. 185 (May, 1901). *From the Editor.*

Field Naturalists' Club of Victoria—Victorian Naturalist. Vol. xviii. No. 1 (May, 1901). *From the Club.*

University of Melbourne—Examination Papers. Final Honour, Degrees, &c., February, 1901. *From the University.*

Department of Mines, South Australia, Adelaide—Record of the Mines of South Australia: Report on the Geological Exploration of the Tarcoola District, with Plan (1901). By H. Y. L. Brown, F.G.S., Government Geologist. *From the Author.*

Department of Agriculture, Perth—Journal. Vol. iii. Part 4 (1901). *From the Secretary.*

Department of Mines, Hobart—Government Geologist's Report on the Mineral Districts of Bell Mount, Dove River, Five-mile Rise, Mount Pelion and Barn Bluff (April, 1901). *From the Secretary for Mines.*

Auckland Institute and Museum—Annual Report for 1899-1900 and 1900-1901. *From the Institute.*

Cambridge Philosophical Society — Proceedings. Vol. xi. Part ii. (1901). *From the Society.*

Entomological Society, London—Transactions, 1900. Part v. *From the Society.*

Royal Microscopical Society, London—Journal, 1901. Part 2. *From the Society.*

Birmingham Natural History and Philosophical Society—Proceedings. Vol. x. Parts i.-ii. and Part i. Section i. (1896-97); Vol. xi. Part i. and Part i. Section i. (1898-99). *From the Society.*

Royal Society, London — Proceedings. Vol. lxviii. No. 443 (March, 1901): Reports to the Malaria Committee. Fourth Series (March, 1901); Fifth Series (April, 1901). *From the Society.*

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Journal de Conchyliologie, Paris. Vol. xlix. No. 1 (1901). *From the Director.*

Société des Sciences Naturelles de l'Ouest de la France, Nantes --Bulletin. Tome x. 3^{e} Trimestre (1900). *From the Society.*

Société Entomologique de France, Paris—Annales. Vol. lxviii. 1er-4^{e} Trimestre (1899); Bulletin. Année 1899. *From the Society.*

Société Linnéenne de Normandie, Caen—Mémoires. xx^{e} Vol. (1899-1900); Bulletin. 5^{e} Série. iii^{e} Vol. (1899). *From the Society.*

Société Nationale des Sciences, &c., de Cherbourg—Mémoires. Tome xxxi. (1898-1900). *From the Society.*

Société Royale de Géographie d'Anvers—Bulletin. Tome xxiv. 4^{e} Liv. (1900); T. xxv. 1^{e} Liv. (1901). *From the Society.*

Société Royal Linnéenne de Bruxelles—Bulletin. 26^{e} Annee. No. 5 (March, 1901). *From the Society.*

Société Royale Malacologique de Belgique, Bruxelles—Annales. Tome xxxiv., pp. cxxix.-clxxv.; pp. 17-28, Tp., &c. (1900). *From the Society.*

R. Università degli Studi di Siena—Bullettino del Laboratorio ed Orto Botanico. Vol. iii. Fasc. iii.-iv. (December, 1900). *From the University.*

Gesellschaft für Erdkunde zu Berlin—Verhandlungen. Band xxvii. Nos. 7-8 (1900); Zeitschrift. Band xxxv. No. 3 (1900). *From the Society.*

Senckenbergische Naturforschende Gesellschaft in Frankfurt a.M.—Abhandlungen. xxv. Band. 2 Heft (1901). *From the Society.*

Naturhistorische Gesellschaft zu Nürnberg—Abhandlungen. xiii. Band (1899). *From the Society.*

Three Separates (from the Zoologischer Anzeiger, Band xxii.-xxiii.). By Prof. Dr. V. Sixta. *From the Author.*

Zoologischer Anzeiger, Leipzig. xxiv. Band. Nos. 639-641 (March-April, 1901). *From the Editor.*

Nederlandsche Entomologische Vereeniging, Hague—Tijdschrift voor Entomologie. xliii. Deel. 3-4 Afl. (1901). *From the Society.*

Société Hollandaise des Sciences à Harlem—Archives Néerlandaises. 2^e Série. Tome iv. 2^e Liv. (1901). *From the Society.*

Académie Impériale des Sciences de St. Pétersbourg—Annuaire du Musée Zoologiqne, 1900. Tome v. No. 4. *From the Academy.*

Naturforschende Gesellschaft in Bern—Mittheilungen aus den Jahren 1898 u. 1899. *From the Society.*

Académie Royale des Sciences et des Lettres de Danemark, Copenhague—Oversigt. 1900, Nr. 6; 1901, Nr. 1: Fortegnelse, Januar, 1901. *From the Academy.*

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Videnskabs-Selskabet i Christiania—Skrifter. i. Mathematisk-naturv. Klasse, 1900. No. 1. *From the Society.*

American Geographical Society, New York—Bulletin. Vol. xxxiii. No. 1 (1901). *From the Society.*

American Museum of Natural History, New York—Bulletin. Vol. xi. Part iii. (1900); Vol. xiv. Articles vi.-viii. (March-April, 1901). *From the Museum.*

American Naturalist, Cambridge. Vol. xxxv. No. 412 (April, 1901). *From the Editor.*

American Philosophical Society, Philadelphia—Proceedings. Vol. xxxix. No. 163 (July-September, 1900). *From the Society.*

Denison University, Granville, Ohio—Bulletin of the Scientific Laboratories. Vol. xi. Article ix. (June, 1900). *From the University.*

Indiana Academy of Science, Indianapolis—Proceedings, 1898

Museum of Comparative Zoology, Harvard College, Cambridge, Mass.—Bulletin. Vol. xxxvi. Nos. 5-6 (1900); Vol. xxxviii. (Geological Series, Vol. v. Nos. 1-3, Nov. 1900-March, 1901). *From the Director.*

New York Academy of Sciences—Annals. Vol. xiii. Part 1 (1900): Memoirs. Vol. ii. Part 2 (1900). *From the Academy.*

Wagner Free Institute of Science, Philadelphia—Transactions. Vol. iii. Part v. (December, 1900). *From the Institute.*

Natural History Society of New Brunswick, St. John—Bulletin. Vol. iv. Part 4 (1901). *From the Society.*

Natural History Society of Montreal—Canadian Record of Science. Vol. viii. Nos. 3 and 5 (1900-01). *From the Society.*

Smithsonian Institution, Washington: U.S. National Museum—Bulletin. No 47. Part iv. (1900): Special Bulletin. No. iv. American Hydroids. Part i. The *Plumularidiæ* (1900). By C. C. Nutting. *From the Museum.*

U.S. Department of Agriculture, Washington—*Division of Agrostology.* Circulars. Nos. 29-30 (1901): *Division of Botany*—Bulletin. No. 26 (1901): *Division of Entomology*—Bibliography of American Economic Entomology. Part vii. (1901): *Division of Vegetable Physiology and Pathology*—Report, No. 68 (1901). *From the Secretary for Agriculture.*

Biological Club of the Ohio State University, Columbus—Ohio Naturalist. Vol. i. No. 6 (April, 1901). *From the University.*

Washington Academy of Sciences — Proceedings. Vol. iii. pp. 1-110, Pls. i.-xii.; pp. 111-155 (March-April, 1901). *From the Academy.*

Instituto Geológico de Mexico—Boletin. Num. 14. Las Rhyolitas de Mexico. Primera Parte (1900). *From the Institute.*

Geological Survey of India, Calcutta—Memoirs. Vol. xxxiii. Part 1 (1901). *From the Director.*

Perak Government Gazette, Taiping. Vol. xiv. Nos. 14-17 (March-April, 1901). *From the Government Secretary.*

THE NATURE OF THE BACTEROIDS OF THE LEGUMINOUS NODULE AND THE CULTURE OF *RHIZOBIUM LEGUMINOSARUM.*

By R. Greig Smith, M.Sc., Macleay Bacteriologist to the Society.

In a recent publication[*] L. Hiltner discusses the views of Stutzer with regard to the nature of the bacteroids of the nodules of the *Leguminosæ.* The generally accepted view is that the bacteroids of the nodule are degenerate or involution forms of *Rhizobium leguminosarum.* Stutzer considers that they represent a higher and not a lower type of growth, and to this Hiltner replies that he cannot see why they should be so considered. His own view is that the bacteroids are simply enlarged bacteria.

In a former paper[†] I showed that the branching forms were really simple cells contained in a branching capsule. This is the case both with the organisms in artificial culture and in the root nodules. One has only to extract the colouring matter from the capsule after staining a bacterial film to see the simple cells within. There is no reason to suppose that the γ or the Y form is either degenerate or specialised; they are simply single cells contained in the bulky mother capsule from which the daughter cells are unable to escape until they have increased in size and become stronger or until the capsular envelope has become dissolved either partially or wholly by the fluids of the plant tissue.

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[*] Hiltner, Centralblatt fur Bakt. ii. Abt. vi. 273.

[†] These Proceedings, 1899, Part 4, pp. 653-673.

We have to remember that Prazmowski saw that the infecting thread contained rod-like cells, and that Maria Dawson while corroborating this noted that the gelatinous membrane (capsule) of the tube either became dissolved, whereby the rods were liberated, or the cells budded off *Dematium*-like. There is no reason to suppose that the same thing does not occur with the bacteroids; it is as unnecessary to suppose that the branching infecting thread is of a nature different to the branching bacteroids as that the cells in a chain of bacilli differ from a single isolated cell of the same species. The γ form of *Rhizobium* differs from the Y form only in the age of the daughter cells. In the γ form one or both of the daughter cells are immature (buds), while in the Y form they are mature (rods) and ready to escape from the enclosing membrane. There should never have been any question of degeneration or of specialisation: they are simply normal cells. Beijerinck has shown that the nature of the capsule can be altered at will in artificial media, and that forms precisely similar to those seen in the nodule can be obtained in artificial culture. The condition necessary for this appears to be the presence in the faintly acid culture fluid of potassium phosphate and a thin layer of fluid in the culture flasks.

The γ and Y bacteroidal forms are always observed in the young cultures in artificial media: in old cultures only the rod forms are present. This is the case not only with the nodule-former, but also, according to Sewerin and corroborated by the writer, with *Mycobacterium denitrificans*, an organism that produces similar branching forms in young (24 hours) cultures. This is in itself enough to negative the idea that these are degeneration forms, and, as I have pointed out, the specialisation hypothesis is unnecessary.

As for Hiltner's view that the bacteroids are large bacteria, it is quite possible, but it is not always so, as in working with the lupin bacteroids I have seen little difference in size between the cells contained within the bulky capsule and the cells obtained in artificial culture. Bacteria undoubtedly differ in size according to the media in which they are cultivated, and, as I have shown, *Bac. megatherium* occurs in the acid fluid of the nodules similar in size to that originally observed by De Bary.

In a Scandinavian publication abstracted in the Experimental Station Record, xi, 1013, L. Hiltner, after summarising previous investigations relative to the fixation of atmospheric nitrogen, says that the nodule organisms are true parasites and secrete peculiar substances that cause the root hairs to shrivel up. "The injurious influence of the secretory products disappears when the tubercles attain their final development, but since these products continue to form inside the mature tubercle the supposition is that they are immediately converted into substances harmless to the plant. Such a conversion takes place with the co-operation of the host plant by supplying the organism with a part of the nutritive substances produced by the plant. This is further corroborated by the fact that from legumes and alders bacteria can be grown only in nutrient media containing extracts from the roots of leguminous or alder plants. The exclusive preference which is shown by *Bacillus radicicola* to leguminous plants tends to prove that the *Leguminosæ* alone are capable of producing the substances necessary for bacteria, the nature of which is being investigated." Although infusions of leguminous plants are commonly employed for the culture of the organisms that frequent the root nodules, it must not be assumed from this that the plant extract is absolutely necessary for the growth. The bacteriologist employs media which he considers will be best suited to the growth of the particular organism. For this reason extract of meat is used for the bacteria that are parasitic in animals, whey is used for milk bacteria, beer or yeast extract for the saccharomycetes, and so on. But most of the bacteria parasitic in animals will grow in media devoid of meat extract, and milk bacteria in media containing no milk. It is true that the nodule-formers are not found in plants other than the *Leguminosæ*, but we are no more entitled to assume from this that leguminous plants contain substances absolutely necessary for the growth of *Rhizobium* than that the tissues of man alone contain substances that are absolutely necessary for the growth of *Bact. typhi*, *Vibrio* *cholerae*, &c. In fact, as I pointed out in the paper already quoted, " Extract of lupins or other leguminous plant does not seem a necessity for the culture media. Grass will do quite as well, and for that matter the plant extract might be left out entirely." Fairly luxuriant cultures were obtained upon a gelatine medium containing glucose and inorganic salts, and since that time I have cultivated the organism upon a medium containing faintly acid agar (2 %), glucose (2 %) and inorganic salts ($CaCl_2$ and KH_2PO_4) nearly neutralised with KOH.* On the latter medium there is no nitrogen except that which may be present as impurity in the washed agar, the glucose or the tap water. I have also grown the organism in an agar-free fluid medium prepared exactly as the agar medium. Such a fluid after inoculation becomes turbid and forms a slight sediment of organisms together with a bulky zooglœa cloud or sedimentary film.

The apparent growth in this very poor medium led to the belief that fixation of nitrogen might have occurred, but this was dispelled when the experimental flasks holding 250 c.c. of culture fluid were found to contain exactly the same amount of nitrogen (0·6 milligrm.) as was contained in control flasks.

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* The method of preparing the faintly acid medium is described in these Proceedings, 1899, Part 4, p. 663.

ON ONE OF THE SO-CALLED HONEYSUCKLES OF LORD HOWE ISLAND.

BY J. H. MAIDEN, BOTANIC GARDENS, SYDNEY.

Professor Radlkofer, of Munich, described a plant in *Sitzungsberichte der Königl. bayr. Akad.* 1878, p. 326, from imperfect material (male flowers only) collected by Fullagar, as *Atalaya coriacea.*

Later on he described the same plant from more perfect material received from my predecessor, Mr. Charles Moore, as *Guioa coriacea* in his "Monographiæ generis Serjaniæ Supplementum" (*Abhandl. der K. bayr. Akad.* 1886, p. 60).

Already at that time Professor Radlkofer regarded it as identical with *Cupania anacardioides*, F.v.M., (*not* A. Rich.), in *Fragm.* ix., 91, 1875, collected by Fullagar. Hemsley apparently overlooked this in his "Flora of Lord Howe Island" (*Ann. Bot.* x., 234, 1896), and mentions *Cupania anacardioides*, F.v.M., and *Atalaya coriacea* as different plants. The *Nephelium (Cupania) semiglauca* mentioned by Hemsley in the same work as from Lord Howe Island, is evidently only a fruiting specimen of *Guioa coriacea.*

Tate (*Macleay Memorial Volume*, 220) mentions *Cupania anacardioides*, Rich., (should be F.v.M), and *Nephelium semiglaucum*, F.v.M., (a slip of the pen) for "a plant allied to *N. semiglaucum.*"

See also my paper, "Observations on the Vegetation of Lord Howe Island," in these Proceedings, 1898, in which, at p. 126, I describe a *Cupania* under the name *C. Howeana.*

After examining the evidence and such specimens as are available to me (Lord Howe specimens labelled *Atalaya* or *Guoia coriacea* by Prof. Radlkofer are not in the Melbourne herbarium, nor were they at the time I read my former paper), it appears to me that there is only one *Cupania* (so-called) on Lord Howe Island, and following is its synonymy :—

Atalaya coriacea, Radlkofer (*supra*). This was altered, when fruits were found, to
Guioa coriacea, Radlkofer (*supra*).
Cupania anacardioides, F.v.M., *non* A. Rich. (1875).
Nephelium semiglaucum, Tate, *non* F.v.M. (*supra*).
Cupania Howeana, Maiden, *Proc. Linn. Soc. N.S.W.*, 1898.

To Prof. Radlkofer, therefore, belongs the credit of first describing this plant, but what name it should bear is not so clear, and will depend on the extent to which botanists follow this eminent man in dealing with the Order. Following are some of the changes in the nomenclature of our New South Wales genera and species which Radlkofer proposes, and as these changes were not adopted by Baron von Mueller there can be no harm in our further considering the subject before such radical changes are made :—

54. ALECTRYON, Gærtn.
    connatus, Radlk. (*Nephelium connatum*, F.v.M.).
    subdentatus, Radlk. (*N. subdentatum*, F.v.M.).
    tomentosus, Radlk. (*N. tomentosum*, F.v.M.).
    subcinereus, Radlk. (*N. leiocarpum*, F.v.M.).

76. GUOIA, Cav.
    semiglauca, Radlk. (*Cupania semiglauca*, F.v.M.).
    coriacea, Radlk. (*Atalaya coriacea*, Radlk.).

77. CUPANIOPSIS, Radlk.
    anacardioides, Radlk. (*Cupania anacardioides*, A. Rich.).
    serrata, Radlk. (*Cupania serrata*, F.v.M.).

84. SARCOPTERYX, Radlk.
    stipitata, Radlk. (*Ratonia stipitata*, Benth.).

85. JAGERA, Blume
    pseudorrhus, Radlk. (*Cupania pseudorrhus*, A. Rich.).

87. Tœchima, Radlk.
    tenax, Radlk. (*Ratonia tenax*, Benth.).

90. Elattostachys, Radlk.
    xylocarpa, Radlk. (*Cupania xylocarpa*, A. Cunn.)
    nervosa, Radlk. (*Cupania nervosa*, F.v.M.).

91. Arytera, Blume
    divaricata, F.v.M. & Radlk. (*Nephelium Beckleri*, Benth.)

92. Mischocarpus, Blume
    pyriformis, Radlk. (*Ratonia pyriformis*, Benth.).

REVISION OF THE GENUS *PAROPSIS.*

By Rev. T. Blackburn, B.A., Corresponding Member.

Part VI.

[Treating of the species forming Groups i., ii. and v., as characterised in P.L.S.N.S.W. 1896, p. 638.]

In this (the concluding) part of my Revision of the genus *Paropsis* I propose to deal with the groups which in my tabulation of groups (P.L.S.N.S.W. 1896. p. 638) are numbered i., ii. and v. I find, however, as a result of studying the very large number of species that have come into my hands since I drew up that tabulation, that the distinctness of Groups ii. and v. cannot be maintained. Dr. Chapuis based his classification of *Paropsis* entirely on the sculpture of the elytra, and consequently grouped together in his first aggregate species that differed *inter se* in the structure of the prothorax, in my opinion a much more important character, and divided the genus thus:—

1. Species having the elytral punctures without linear arrangement.
2. Species having the elytral punctures partially linear.
3. Species having the elytral punctures wholly linear and in 10 rows.
4. Species having the elytral punctures wholly linear and in more numerous rows.

This classification involved the intermingling, in two of Chapuis' aggregates, of species having the prothorax normal laterally and species having the prothorax sinuous and mucronate laterally; and I proposed to amend that flaw by regarding the structure of the prothorax as the primary character for classification, which involved removing certain species from the first aggregate. These species, however, could not be placed in any of Chapuis' other aggregates, and I proposed to form them into a separate aggregate to stand as No. ii. Among the species subsequently brought under my notice, however, are several which so decidedly link to this newly formed aggregate that which I have called the fifth (and which Chapuis called the second) group as to require the characters of the former to be altered in order to admit into it my Group v. (Chapuis' Group ii.). In my former tabulation of the Groups of *Paropsis* I altered Chapuis' classification otherwise by transposing the position of its Groups iii. and iv. and also regarded its two subdivisions of its Group iv. as primary divisions of the genus. To these alterations I adhere, and therefore my tabulation of the Groups of *Paropsis* will stand as follows:—

A. Sides of the prothorax mucronate in front, or sinuous about the middle, or both..	Group i.
AA. Sides of the prothorax evenly arched.	
*B. Puncturation of the elytra non-seriate, or only partially seriate through the presence of unpunctured longitudinal spaces...............	Group ii.
BB. Elytra seriate punctulate in about 20 rows.	
C. Elytra verrucose...............................	Group iii.
CC. Elytra non-verrucose..................	Group iv.
†BBB. Elytra seriate-punctulate in 10 rows.............	Group v.

In the former parts of this series of memoirs I have dealt with Groups iii., iv. and v. (the last being there called Group vi., as explained above), which contain by far the larger part of the species of the genus. I now offer a memoir completing the work, and begin with

GROUP I.

The character by which this aggregate is distinguishable from all the rest is the peculiar shape of the prothorax, the lateral outline of which is not evenly arched (as it is in the other groups), but departs from that form by either (*a*) having its apex mucronate, or (*b*) having a notch or arcuate concavity about its middle, or (*c*) having both the above characters. There are a few species in which this prothoracic peculiarity is very feeble, the unevenness of lateral outline being only a slight median sinuosity, and those species are very closely allied to some of the species in Group ii. But in an enormous genus such as *Paropsis* subdivision is impossible unless *some* character be applied with a rigour that more or less runs counter to natural order in separating species that apart from that character might be placed side by side. I believe that the system and subdivision I have adopted will be found to traverse obvious affinities less frequently than any other system that could be suggested.

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* This aggregate comprises Groups ii. and v. of my former tabulation (*loc. cit.*).

† This aggregate stands as Group vi. in my former tabulation (*loc. cit.*).

In this present Group there is only one species in which the sculpture of the elytra approaches the type of regular seriate puncturation, viz., *P. aspera*, Chp.,—which its author placed in his fourth "Groupe," my third—where (the form of its prothorax being disregarded) it certainly seems more at home; but as the apical angles of its prothorax are very strongly mucronate it must be a highly isolated species wherever placed.

The species of this group are insects of firm texture and non-metallic colouring, most of them of comparatively large size and less liable to change colour after death than are the members of some other groups. Many of the species are very closely allied, *inter se*, but on the whole distinguishable by more definite characters than are those of the more numerous groups. The difficulty of identifying the insects referred to in published descriptions is, however, very great, as there is scarcely a species known to me in which the colours are not variable to the utmost extent, and in the majority of the existing descriptions colour is treated as a prominent character.

The only colour-character on which I have ventured to place any confident reliance is the colour of the under surface. In some species the under surface is of a deep shining black which varies by being interspersed with clearly contrasted yellow. In the rest of the species the under surface is red-testaceous or brown, varying into dark piceous, but even in the darkest examples *shading off* into dark colours without sharply defined lines of separation. I have the good fortune to possess the types of some of Chapuis' species, and examples named by that author of other species, as well as a series of specimens named by Mr. Masters after careful comparison with Marsham's types. Of several other species I have examples taken in the exact localities specified by their authors, which enable tolerably confident identification even where the description without such assistance is of too loose a character.

Most of the species of this group have smooth pustules or verrucæ on their elytra, and in many of them these quasi-tubercles form a pattern. Where this is the case I find the nature of the pattern extremely constant and a valuable specific character. It must be noted, however, that the *colours* of the pattern are variable, the quasi-tubercles forming it being usually of lighter tone than the ground colour and therefore being very conspicuous, but in some examples the tubercles are of the same colour as the derm, and in that case (being very slightly elevated) need looking for. The quasi-tubercles that I find to be, in the species having a pattern, constant (specifically) in size and position are four, viz., on each elytron one just within and below the humeral callus, and one on the disc behind the middle. For the sake of convenience I have called these faintly elevated quasi-tubercles, in the following tabulation and descriptions, the subhumeral and postmedian blotches.

In the Journal of Entomology for Dec. 1864, Mr. J. S. Baly published the first part of a study of the species of *Paropsis* in his collection, in which he dealt with those that would fall into my Groups i. and ii., of which he described 12 as new and redescribed 8. His descriptions are good ones, and there is not much difficulty in identifying the insects on which they were founded. He, however, relies largely on the characters of the *œdeagus*, an internal sexual organ which in most specimens can only be examined by dissection, for determination of species; and therefore his diagnosis can be used thoroughly only when specimens can be spared for destruction. Unfortunately he never published a second part of his work. There are some errors in what he published which the quasi-types of Marsham's *Paropses* (referred to above) have enabled me to detect and which will be found noted in the following pages. Of the 20 species described by Baly, seventeen belong to my Group i., and the other three to my Group ii.

The species not distinguished by an elytral pattern and having their prothorax similar in form are as a rule closely allied *inter se*, and their specific difference seems to consist chiefly in their *form* (more or less elongate or more or less convex) and their sculpture (more or less strong or more or less close). Such differences are not easy to formulate in language precise enough to be useful in a tabulation, but where they really are the essential differences it is necessary to make the attempt to express them clearly, which I have done in the present instance by comparing the degree of convexity, &c., with the same in some other species, choosing as the standards of comparison only well-known and more or less common species. I am, of course, not forgetful of the fact that differences of convexity and even of sculpture are very frequently *sexual*, and therefore when I characterise a *Paropsis* as *(e.g.)* more or less convex than some other species, I mean "more or less convex than the corresponding sex (the male than the male, the female than the female) of that species."

One other of the characters that I have relied upon in grouping the species of this aggregate seems to call for explanation. I have contrasted two types of elytral puncturation as "acervate" and "evenly spaced or nearly so." The puncturation which I have called "acervate" is not invariably in "clusters" (strictly so called), but in some species runs in short usually oblique lines, yet in such fashion that the interspaces between these lines of punctures are of considerably different size; while the puncturation that I have called "evenly spaced or nearly so" does not, or scarcely, run in lines, and the interspaces of the punctures are all very similar, *inter se*.

With these explanations I cherish the hope that, notwithstanding the close resemblance of these species, *inter se*, it will be practicable to identify them by means of the following tabulation and descriptions.

In 1877 Dr. Chapuis (Ann. Soc. Ent. Belg.) published a Synopsis of the species of *Paropsis* (already referred to in previous parts of my Revision) in which he enumerated and distributed among his four "groupes," referred to above, the species described by former authors; and he added descriptions of a number of new species. In that Synopsis he attributed to his first "groupe" 21 previously named species (two of which, *Waterhousei*, Baly, and *fulvoguttata*, Baly, cannot stand in my first Group on account of the sides of their prothorax being evenly arched), and described six new species, all of which will stand in my first Group.

Fifty-eight names in all have been proposed for insects that can be confidently regarded as members of my first Group, and also five of Boisduval's names (*crocata*, *morbillosa*, *miliaris*, *granulosa* and *rugulosa*) may *possibly* appertain to members of it, but the descriptions are so insufficient that they must be treated as if they were non-existent. A certain number of the fifty-four names have already been relegated by previous authors to the category of synonyms, but as this has been in some instances done incorrectly, it seems desirable here to furnish a statement of synonymy, the grounds of which will be found more fully set forth where necessary in the following pages under the heading of the names concerned.

P. testacea, Germ. = *Wilsoni*, Baly.
sanguinipennis, Germ. = *reticulata*, Marsh.
atomaria, Marsh. = *Charybdis*, Stäl.
consimilis, Baly = *lutea*, Marsh. (not previously noted).
lutea (Baly, *nec* Marsh.) = *ægrota*, Boisd. (not previously noted).
quadrimaculata, Marsh. = *reticulata*, Marsh., var.
dilatata, Er., and *incarnata*, Er., represent valid species. Mr. Baly thought them probably synonyms of *atomaria*, Marsh., and *reticulata*, Marsh.
ægrota, Boisd., represents a valid species. Mr. Baly thought it a synonym of *lutea*, Marsh.
nigroscutata, Chp., probably equals *Lownei*, Baly.

Thus there remain fifty-one names of already described species which appear to me likely to stand as valid. Of these I believe that I have before me examples of all except three, viz. (*a*) *P. formosa*, Chp., which appears to be a very remarkable *Paropsis*, having an oblique costa on the hinder part of the elytra. Its prothorax is described as bisinuate laterally, but in other respects the description does not furnish particulars that would enable me to place it in my tabulation. (*b*) *P. Parryi*, Baly, a large species believed to have been taken in tropical Australia, which is probably near my *P. Hygea*, but seems to have the elytra sculptured differently from the elytra of that species. (*c*) *P. pantherina*, Fauv., a species said to have been found at Sydney and to be very rare; as it is not compared with any other species, there is much difficulty in forming any clear idea of it; the sides of its prothorax are described as strongly sinuate in front of the middle, and I cannot find any definite character ascribed to it by which it could be distinguished from *P. obsoleta*, Marsh., with a strongly coloured specimen of which the markings attributed to *P. pantherina* agree very accurately, but it seems difficult to believe that anyone describing new *Paropses* would be unacquainted with so common an one as *P. obsoleta*.

In the following pages I describe twelve new species belonging to this Group, making the total number of species sixty-three, and the total enumerated in the tabulation sixty:—

A. Apical angles of prothorax mucronate, its sides otherwise normal (or scarcely sinuate).
B. Discal sculpture of hinder half of elytra includes some verrucæ or elevated interstices.
C. Under surface deep black, variegated (if at all) with sharply limited pale colouring.
D. Elytra feebly convex longitudinally, fully twice as long as high (viewed from the side).
E. Elytral sculpture but little enfeebled around scutellum.................. *augusta*, Blackb.
EE. Elytral sculpture much enfeebled around scutellum.

F. Elytral puncturation notably coarser and sparser than in *P. variolosa*, Marsh.
G. Prothorax more than twice as wide as long.......... .... *Manto*, Blackb.
GG. Prothorax not more than twice as wide as long............................ *montana*, Blackb.
FF. Elytral puncturation fully as fine and close as in *P. variolosa*, Marsh. ... *debilitata*, Blackb
DD. Elytra strongly convex longitudinally, height (viewed from side) less than half length.................................. *tasmanica*, Baly.
CC. Under surface testaceous or brown, not varying into sharply contrasted colours.
D. Width of elytra together much greater than half the length of the whole insect.
E. Elytra not having a common gibbosity about the middle of the suture.
F. Large species (about 6 lines long or more) with discal puncturation of elytra acervate.
G. Elytra feebly convex longitudinally, in ♀ more than twice as long as high (viewed from the side).
H. Pronotum moderately punctured (much as that of *P. variolosa*, Marsh.).
I. Puncturation of elytra about as close as in *P. variolosa*.
J. Prothorax twice and one-half as wide as long.
K. Elytra almost devoid of discal verrucæ............ *longicornis*, Black
KK. Elytra with very numerous strongly defined discal verrucæ.......... *dilatata*, Er. ♂.
JJ. Prothorax not more than twice as wide as long....... *Hygea*, Blackb.
II. Puncturation of elytra distinctly less close, and a little coarser............................ *advena*, Blackb.
HH. Pronotum punctured very much less closely than in *variolosa* *angusticollis*, Bla

GG. Elytra strongly convex longitudinally (height, viewed from side, not less than half length, at any rate in ♀).

H. Discal puncturation of elytra very sparse (more so than in *P. obsoleta*, Marsh.)............ ...... *cerea*, Blackb.

HH. Discal puncturation of elytra much closer.

I. Form extremely convex longitudinally (height of elytra in ♀, viewed from side, $\frac{2}{3}$ of length)........... .. .. *affinis*, Blackb.

II. Form distinctly less convex longitudinally.

J. Disc of elytra studded with unpunctured more or less elevated spaces conspicuously larger than the average interstices of the punctures.

K. Elytra having a common subsutural area almost punctureless................ *aciculata*, Chp.

KK. Elytra having a common subsutural area finely but very distinctly punctured .... *variolosa*, Marsh.

JJ. Spaces on disc of elytra interrupting the general puncturation almost wanting.

K. Greatest heighth of elytra (viewed from the side) notably in front of the middle.............. .... *Lownei*, Baly (?)

KK. Greatest height of elytra (viewed from the side) close to the middle...... *Wilsoni*, Baly.

FF. Discal puncturation of elytra evenly spaced or nearly so; if not, size notably smaller than in aggregate "F."

G. Hind part of elytra with the punctuation lost, or nearly so, in very close even granulosity.

H. Elytra (at least in ♂) wider (together) than long, strongly outturned laterally.................. ... *insularis*, Blackb.

HH. Elytra in neither sex wider (together) than long, less outturned laterally (at least in ♂).

I. The rugulosity of front half of elytra consists of close granules or mere narrow interstices of the punctures.

J. Discal puncturation of pronotum strongly acervate.

K. Greatest height of elytra very close to the base..... *incarnata*, Er.

KK. Greatest height of elytra not much in front of the middle...................... *reticulata*, Marsh.

KKK. Greatest height of elytra at or behind the middle.,.. .. .. ***Charybdis*, Stål.**

JJ. Discal puncturation of elytra not, or scarcely, acervate *elytrura*, Blackb.

II. Elytra closely studded with flattened well-defined verrucæ, notably larger in front half than granules.............. .... *Omphale*, Blackb.

GG. Hind part of elytra with verrucæ or granules more distant, fully exposing the punctures.

H. The discal elytral irregularities are small and round verrucæ running in longitudinal rows.

I. The discal verrucæ of elytra numerous, about 20 in each longitudinal row.................. *Bovilli*, Blackb.

II. Discal verrucæ of elytra much fewer, scarcely 10 in each longitudinal row................ *ornata*, Marsh.

HH. The discal elytral irregularities are large, irregular, scarcely raised unpunctured blotches.. *Paphia*, Stäl.

EE. Elytra having a common gibbosity about the middle of the suture.

F. The gibbosity moderate in the female, scarcely indicated in the male........ *dilatata*, Er. (?)

FF. The gibbosity well defined in the male, very strong in the female.... *gibbosa*, Blackb.

DD. Width of elytra together scarcely greater than half their length...................... *aspersa*, Chp.

BB. Hinder half of elytra not having verrucæ or elevated interstices.

C. Legs with sharply defined variegation of yellow and black................................ *pictipes*, Chp.

CC. Legs devoid of sharply defined black markings.

D. The entire elytra with numerous large smooth spaces which are on the front half slightly raised...... .... *Mintha*, Blackb.

DD. The elytra without large unpunctured spaces.

E. Elytra strongly convex longitudinally; height (at least of ♀) ⅔ or scarcely less length, viewed from side.

F. Pronotum without lateral impression. *rufitarsis*, Chp.

FF. Pronotum having a well defined impression on either side near lateral margin.

G. Front angles of prothorax quite strongly mucronate (*i.e.*, lateral margin deeply sinuate immediately behind angle).......................... *Sospita*, Blackb.

GG. Front angles of prothorax very feebly mucronate.

H. Front angles of prothorax strongly acute and produced (resembling those of *Paphia*, Stäl.)........... *confusa*, Blackb.

HH. Front angles of prothorax considerably more blunt............ *Thyone*, Blackb.

EE. Elytra much less convex longitudinally *irrorata*, Chp.

AA. Prothorax with its front angles mucronate and also its sides conspicuously sinuate.

B. Prosternum longitudinally concave.

C. Elytra with smooth, usually elevated, blotches arranged as a pattern.

D. Pronotum strongly irregularly and somewhat rugulosely punctured (after the fashion of *reticulata*, Marsh.)............... *ægrota*, Boisd.

DD. Pronotum not both strongly and irregularly punctured.

E. Elytra with an evident common gibbosity about the middle of the suture.

F. Interval between the subhumeral blotches not greater than between the postmedian.......... .... *lutea*, Marsh.

FF. Interval between the subhumeral blotches considerably greater than between the postmedian.............. *colorata*, Blackb.

EE. Elytra not having a common sutural gibbosity.

F. Postmedian blotch on elytra nearly half width of entire disc and nearly reaching suture. .... *maculata*, Marsh.

FF. All the elytral blotches very much smaller.

G. A smooth discal blotch is of the form of a longitudinal more or less interrupted vitta, and there is no isolated postmedian blotch.... ... *propinqua*, Baly.

GG. The postmedian blotch distinct (not included in a vitta).

H. The postmedian blotch very little behind the middle of the elytra *geographica*, Baly.

HH. The postmedian blotch placed far behind the middle of the elytra............................... *marmorea*, Oliv.

CC. Elytra not having smooth blotches arranged to form a pattern.

D. Puncturation of pronotum of the acervate irregular and rather coarse type (like that of *ægrota*, Boisd.).

E. Puncturation of elytra almost entirely lost in close rugulosity (as in *incarnata*, Er.).

F. The elytral rugulosity runs in closely packed longitudinal lines............. *intermedia*, Blackb.

FF. The elytral rugulosity not longitudinally placed........................ *latissima*, Blackb.

EE. Puncturation of elytra, at any rate on front half, very distinct.

F. Under surface deep black, with or without sharply defined yellow variegation.......................... ... *bella*, Blackb.

FF. Under surface brown or testaceous, clouded or not with somewhat darker shades.

G. Form moderately convex (height, viewed from the side, scarcely more than ½ length of body).

H. Sculpture of pronotum fully as coarse in *ægrota*, Boisd.... .. ... *rubidipes*, Blackb.

HH. Sculpture of pronotum much less coarse........................ *variegata*, Blackb.

GG. Form much more strongly convex when viewed from the side...... *Latona*, Blackb.

DD. Puncturation of pronotum much more regular, usually much closer and not or scarcely acervate.

E. Pronotum not having a lateral depression about the beginning of the coarsely punctured part (puncturation of elytra extremely close) .... *glauca*, Blackb.

EE. Pronotum having a lateral depression, if lateral depression feeble, then elytral puncturation sparse.

F. Lateral inequality of prothoracic outline is a deep angular notch.

G. Elytra dilated hindward from base almost to apex......................... *mutabilis*, Blackb.

GG. Greatest width of elytra much nearer middle of their length.

I. Elytral puncturation sparse (as much so as in *obsoleta*, Marsh.) *mystica*, Blackb.

II. Elytral puncturation considerably closer.

J. The rugulosity of the elytra coarse and strong (at least as much so as in *reticulata*, Marsh.).

K. Discal puncturation of pronotum at least as close as in *lutea*, Marsh.

L. Form extremely convex longitudinally (considerably more so than in *maculata*, Marsh.)... *convexa*, Blackb.

LL. Form moderately convex longitudinally (as in *maculata*, Marsh.) *carnosa*, Baly.

KK. Discal puncturation of pronotum considerably less close (and also very fine)............. .... *Blandina*, Blackb.

JJ. Rugulosity of elytra particularly weak (considerably feebler than in *reticulata*, Marsh.).

K. Puncturation of hind half of marginal part of elytra crowded and subconfluent *roseola*, Baly.

KK. Puncturation of hind half of marginal part of elytra considerably less crowded.................... ***yilgarnensis*, Blackb.**

FF. Lateral inequality of prothoracic outline is an elongate curve (disc of pronotum finely punctured).

G. The discal puncturation of elytra notably more sparse than in *obsoleta*, Marsh..................... ***Zietzi*, Blackb.**

GG. The discal puncturation of elytra notably closer than in *Zeitzi*, Blackb............................ ***obsoleta*, Marsh.**

GGG. Discal puncturation of elytra very close................. .... ***deserti*, Blackb.**

BB. Prosternum not sulcate down middle, or if sulcate having a median carina rising above the sides of the sulcus.

C. Discal puncturation of pronotum very coarse ***porosa*, Er.**

P. AUGUSTA, sp.nov.

Ovata (pone medium sat dilatato-rotundata); modice nitida; minus fortiter convexa; rufo-testacea, antennis (articulis basalibus 4 ex parte rufis exceptis) palporum apice capite in medio et pone oculos mandibulis scutello corpore subtus genubus tibiarum apice et tarsis nigris; capite inæqualiter sat grosse (clypeo subtilius) punctulato; prothorace quam longiori duplo latiori, in disco acervatim subfortiter (ad latera—his late subplanatis—grosse) punctulatis, angulis anticis mucronatis posticis obtusis; elytris obsoletissime costulatis, confuse sat fortiter sat crebre (quam *P. variolosæ*, Marsh., magis fortiter minus crebre) punctulatis, puncturis suturam versus antice parum subtilioribus sed posterius sat subtilioribus, interstitiis transversim confuse (postice quam antice vix magis fortiter) elevatis, parte laterali oblique extrorsum (maris quam feminæ magis fortiter) directa. Long. 8-9, lat. 5¾-6 lines.

♂. Antennis segmentum ventrale 2^{um} attingentibus, elytris quam conjunctim latioribus vix longioribus.

♀. Antennis segmentum ventrale basali vix attingentibus, elytris quam conjunctim latioribus paullo longioribus.

This remarkably fine species is so decidedly larger than any previously described *Paropsis* as to be recognisable on that character alone. Other peculiarities are the quite discernible (though very slight) quasi-costate appearance of the elytra, the considerable outward turn of the extra-discal portion of the elytra (stronger in the male than in the female) and the sudden dilatation of the same about the middle of its length. This species is incapable of confusion with *variolosa*, Marsh., and its close allies on account of its very much less convexity longitudinally (*i.e.*, viewed from the side). The deep black colour of its under surface —in some examples variegated with strongly contrasted yellow— distinguishes it from *Hygea*, &c. From *debilitata* it differs by the much coarser sculpture of its elytra, from *Manto* by its narrower prothorax (which by measurement is scarcely appreciably more

than twice as wide as long), and from *montana* (its nearest ally) by its less convexity (viewed from the side) and by the different puncturation of its elytra (which is very little enfeebled around the front part of the suture, but considerably so a little further from the base, while in *montana* it is considerably enfeebled on the whole front half of the subsutural region).

This is the species that I formerly regarded as *P. Parryi*, Baly, and with hesitation called by that name when I described some new species of *Paropsis* in Trans. Roy. Soc. S.A., 1894, pp. 226, &c. I am now quite satisfied to the contrary. Baly describes *Parryi* as "valde convexa," and uses the phrase "convexa" for some *Paropses* that are less convex than others, which is quite conclusive, as the present species is about the least convex in this group of the genus. Moreover the largest size mentioned by Baly for *Parryi* would make it smaller than the smallest example that I have seen of this insect. And yet again Baly says that *Parryi* "probably came from Northern Australia" (apparently because he found it placed among other species that were certainly from Northern Australia), whereas the present insect is found in Victoria and Southern N.S. Wales. The proportions of its elytra, &c., do not agree with those Baly attributes to *Parryi*, but I do not attach great importance to this, since Baly's statements of proportion are seldom correct, and were evidently not founded on measurement. Baly points out differences between *Parryi* and *variolosa* without referring to the much less convexity of the former, which could not possibly have escaped the notice of so careful a describer if his *Parryi* had been my *augusta*.

Victorian Alps; also N.S.W. (Mount Kosciusko), sent by Mr. Lea.

P. Manto, sp nov.

♀. Ovata (apicem versus modice dilatata); modice nitida; minus fortiter convexa; rufo-testacea, antennis (articulis basalibus 4 ex parte rufis exceptis) palporum apice capite in medio mandibulorum apice scutello corpore subtus femoribus tibiarum apice tarsisque nigris; capite inæqualiter sat grosse (clypeo subtilius) punctulato; antennis quam corporis dimidium vix longioribus; prothorace quam longiori ut 10 ad 4½ latiori, in disco acervatim subfortiter (ad latera—his late subplanatis—grosse) punctulatis, angulis anticis mucronatis posticis obtusis minus rotundatis; elytris confuse sat fortiter sat crebre (quam *P. variolosæ*, Marsh., magis fortiter minus crebre) punctulatis, puncturis suturam versus multo subtilioribus, interstitiis transversim confuse (postice quam antice vix magis fortiter) elevatis, parte laterali oblique extrorsum modice (quam *P. augustæ*, ♀ minus fortiter) directa; elytris quam conjunctim latioribus vix longioribus. Long. 7¾, lat. 5¾ lines.

This is one of a group of closely allied species (*augusta, montana*, &c.). From *augusta* it differs *inter alia* by its shorter form (viewed from above), its decidedly greater convexity (very evident viewed from the side), its wider prothorax, the considerably finer puncturation of the elytra near the scutellum, its elytra not having a conspicuous lateral dilatation about the middle; from *debilitata* by the much less fine and close elytral sculpture; and from *montana* which is its nearest ally by the considerably more transverse form of its prothorax, which is quite well marked by measurement, and looks much greater still to the eye. From *variolosa*, Marsh., and its immediate allies it is very distinct on account of its form being (when viewed from the side) much more elongate with the curve of its upper outline much less convex.

N.S. Wales.

P. DEBILITATA, Blackb.

The type of this species remains, so far as I know, unique. The size and closeness of the punctures on its elytra are very much as in *variolosa*, Marsh. As the locality is one from which more specimens of a valid species might reasonably have been expected, I think the unique example—notwithstanding much difference of puncturation from the somewhat numerous specimens of *P. montana* that I have seen—may possibly be only an aberration of that insect.

P. Hygea, sp.nov.

♀. Ovata (apicem versus modice dilatata); modice nitida; minus fortiter convexa; rufa, mandibulorum apice nigro; capite acervatim sat fortiter (clypeo subtilius) punctulato; antennis quam corporis dimidium haud longioribus; prothorace quam longiori duplo latiori, in disco acervatim subfortiter (ad latera —his late subplanatis—grosse) punctulatis, angulis anticis mucronatis posticis rotundatis; elytris confuse minus fortiter crebre (quam *P. variolosæ*, Marsh., fere magis crebre minus fortiter) punctulatis, puncturis suturam anticam versus multo subtilioribus, interstitiis antice transversim confuse elevatis postice crebre nec fortiter verrucosis, parte laterali oblique extrorsum modice directa; elytris quam conjunctim latioribus vix longioribus. Long. 8, lat. 6 lines.

This species is slightly more convex (viewed from the side) than the preceding species, approaching thereby somewhat to the strongly convex aggregate. Its greatest height, however (viewed from the side) is distinctly less than half the length of its elytra (by measurement). It is at once separable from *augusta*, *debilitata*, *Manto* and *montana* by its entirely pale red colour (except the apex of the mandibles), even the antennæ having no infuscation. Probably it varies in colour, but not, I am convinced, towards the colouring of under surface, legs, &c., of the species just named. Apart from colour, however, its elytra are more closely punctulate than those even of *debilitata* (a trifle more so than of *variolosa*); and it differs otherwise from *debilitata* by the much closer and stronger rugulosity of its elytra, especially near the apex, as well as by its greater convexity (at any rate in the ♀). From those previously described species of the less convex aggregate which are not coloured like *augusta*, &c., it differs (apart from colour) as follows, *inter alia* :—From *longicornis* by its much shorter antennæ in the same sex and less transverse prothorax (which is exactly twice as wide as long), from *advena* by its much larger size and much closer elytral puncturation, and from *angusticollis* by its much broader form and infinitely more

I have in my collection a ♀ example (also from N. Queensland) of a *Paropsis* which I take to be a variety of this species. It is smaller (long. 7 lines) and has the elytral punctures blackish, otherwise not differing much. I have seen so few *Paropses* from tropical Australia that I hesitate as to whether one or two other slight differences may not point to specific distinction.

This species differs from Baly's description of *P. Parryi* in not being "valde convexa" nor black on the under surface.

N. Queensland (Cowley).

P. Lownei, Baly (?).

I have not seen an authentic type of this insect, nor any specimen that thoroughly agrees with the description. Nevertheless, in view of Mr. Baly's reporting it as occurring near Sydney, and being in at least two European collections, it seems hardly likely that I have not seen it among all the numerous large collections of *Paropses* that I have examined. Mr. Masters has sent me a specimen labelled "*Lownei*," but accompanied by a note of uncertainty as to the authority for the name. This specimen differs from the description in the absence of black markings on the pronotum, in the scutellum being (not black but) dark fuscous, and in the prothorax (not "much" but) a little narrower than that of *variolosa*, Marsh. In spite of these discrepancies, however, I incline to the opinion that the specimen is rightly named, and consequently I have placed it in my tabulation, though indicating the doubt as to my identification by the appended "?"

P. incarnata, Er.

This name has usually been regarded as a synonym of *P. reticulata*, Marsh. I have a long series of specimens from Tasmania before me, and also a long series of *P. reticulata* from the Continent (including an example carefully compared with Marsham's type), and am quite satisfied that the names are founded on distinct species. Placed beside *P. reticulata*, *incarnata* is seen, viewed from the side, to be a distinctly more convex insect (the summit of its outline curve having a distinct suspicion of gibbosity, which is entirely absent in *reticulata*), with its greatest height evidently (though not much) nearer to the base of the elytra,—these distinctions of form more strongly marked in the male than in the female; and the verrucosity of the elytra is very considerably stronger in both sexes (as usual, stronger in both species in the male than in the female), the verrucæ on the elytra of the female being clearly stronger and closer than even on the *male* of *reticulata*.

P. CHARYBDIS, Stäl.

Chapuis gives *Charybdis* as a synonym of *atomaria*, Marsh., and Baly doubtfully cites *dilatata*, Er., as a synonym of the same species. I have already (Trans. R. Soc. S.A., 1894, p. 221) discussed this tangle and pointed out that *atomaria* is a nom. præocc. in the genus; in my note, however, I accepted the whole of this synonymy, and therefore selected *dilatata*, Er., (it being an older name than *Charybdis*) as the name that must stand for *atomaria*, Marsh. Since that time, however, I have taken in Tasmania (and also received from Mr. A. Simson) a *Paropsis* which I am confident is *dilatata*, Er., and find it very distinct from *atomaria*, Marsh. It is not practicable to decide with certainty, from the description, on what insect the name *Charybdis* was founded, but Chapuis' determination is entitled to acceptance (though he does not give his reasons for it) until reason is shown to the contrary, and therefore *atomaria*, Marsh., must be regarded as a synonym of *Charybdis*, Stäl.

P. ELYTRURA, sp.nov.

Ovata; minus nitida; sat fortiter convexa (e latere visa fere ut *P. reticulata*, Marsh.); rufa vel testacea, vel partim rufa partim testacea, exemplis nonnullis nigro- vel piceo-variegatis, corpore subtus pedibusque testaceis, antennis apicem versus vix infuscatis; capite (clypeo incluso) sat confertim vix fortiter sat æqualiter punctulato; antennis quam corporis dimidium vix longioribus; prothorace quam longiori ut 7 ad 3 latiori,

in disco confertim dupliciter (subtiliter et minus subtiliter) punctulato, ad latera (his vix impressis et quam *P. reticulatæ*, Marsh., minus deplanatis), grosse rugulosis, angulis anticis mucronatis posticis rotundatis; elytris (fere ut *P. reticulatæ*, Marsh.), confertim granulosis. Long. 5-6, lat. 4-4⅕ lines.

Maris elytris quam conjunctim latioribus vix (feminæ paullo) longioribus.

Closely allied to *P. reticulata*, Marsh., and not differing from it much except in the puncturation of the head and disc of pronotum, which is very different, consisting of close scarcely irregular or acervate punctures; of these some are fine and others evidently less fine, and they are all confusedly intermingled. It is to be noted also that in this species the vague fovea-like impression on either side of the pronotum is evidently feebler than in *reticulata*, and that the lateral coarsely sculptured part of the pronotum continues the convexity of the disc almost evenly instead of being (as it is in *reticulata*) somewhat flattened out.

W. Australia; Albany (Meyrick) and Swan River (Lea).

P. OMPHALE, sp.nov.

♀. Ovata; minus nitida; sat fortiter convexa (e latere visa fere ut *P. Charybdis*, Stål); testacea, nonnullis exemplis supra rufescentibus vel piceo-umbratis, elytrorum verrucis albis vel pallide flavis; capite modice sat acervatim punctulato; antennis abdomen fere attingentibus; prothorace ut 6 ad 2⅗ longiori, in disco acervatim subfortiter (ad latera—his manifeste deplanatis—grosse) punctulato, angulis anticis mucronatis posticis rotundatis; elytris crebre verrucosis, verrucis nonnihil ut *P. reticulatæ*, Marsh., sed in elytrorum parte antica dimidia multo majoribus et hic puncturis inter verrucas valde perspicuis. Long. 5, lat. 3⅘ lines.

This is a very distinct species. In form it resembles *P. Charybdis*, Stål, but is evidently less convex longitudinally. The sculpture of its elytra is of the same kind as in *P. reticulata*, Marsh., but the elevations on the front half are much larger in

area, resembling those of the insect which I regard as the ♀ of *dilatata*, Er., (but in that species they are very much less numerous); in the hinder half the elevations become closely packed granules like those of *reticulata*. In the unique type the verrucæ and granules are of an ivory white colour. A specimen in Mr. Masters' collection, which I regard as a variety, from the same region, has the prothorax a trifle more transverse and its sides slightly sinuate.

Tropical Queensland; taken by the late Mr. Cowley.

P. DILATATA, Er.

I have already alluded to the fact that the males of *Paropsis* are usually less convex in form than the females. This sexual difference is exaggerated to an extreme in the Tasmanian insect that I take to be *dilatata*. The male agrees with Erichson's description in being less convex than *incarnata*, but the female is notably more convex than the female of that species with its elytra very evidently gibbous about the middle of the suture, and is one of the most convex forms in this group of the genus. The species is easily distinguishable from *incarnata*, Er., *Charybdis*, Stäl (*atomaria*, Marsh.), *reticulata*, Marsh., and *elytrura*, Blackb., (the aggregate among which Mr. Baly thought it to stand), apart from sexual characters by the much less even distribution of its elytral sculpture and the strong subangular dilatation of the elytra about the middle of their lateral outline. Its sexual characters make it an isolated species in the genus, but I think its place in a natural arrangement would be not far from *longicornis*, Blackb., (another isolated species) with which it seems to have a good deal of affinity. Owing to the great diversity between the male and female I have been obliged to place the sexes in separate aggregates in my tabulation.

P. MINTHA, sp.nov.

♂ Sat late ovata; minus fortiter convexa (elytrorum longitudine e latere visa quam altitudo fere duplo majori, altitudine antennis (articulis basalibus 4 exceptis) et in elytrorum disco puncturis nigricantibus; capite sat crebre punctulato; antennis minus elongatis; prothorace quam longiori duplo latiori, in disco acervatim sat fortiter valde sparsim (ad latera grosse nec crebre) punctulato, angulis anticis mucronatis posticis rotundatis, lateribus evidenter deplanatis; elytris reticulatim rugatis, rugis punctulatis, interstitiis inter rugas anticis obsolete convexis posticis planis. Long. $5\frac{1}{2}$, lat. $4\frac{2}{5}$ lines.

Easily distinguishable from nearly all the other species of this group by the hind one-third of the elytral disc being entirely without verrucæ or granules, the surface being flat and reticulated with fine punctulate wrinkles. The elytral sculpture is of the same type as in *P. cerea*, Blackb., but in that species the interstices of the wrinkles are distinctly convex throughout, and the outline viewed from the side is (at an rate in the ♂) much more convex. Probably the ♀ of this species is a more convex insect longitudinally, and probably the colouring of the elytral punctures is variable.

North Queensland (Charters Towers).

P. SOSPITA, sp.nov.

♀. Sat late ovata; fortiter convexa (e latere visa fere ut *P. obsoleta*, Marsh., conformata); rufo-brunnea elytris hic et illic obsolete piceo-umbratis; capite crebre subtilius sat æqualiter punctulato; antennis modicis; prothorace quam longiori ut 13 ad 6 latiori, in disco ut caput (ad latera vix grosse) punctulato, utrinque latera versus profunde foveolato, angulis anticis mucronatis posticis obtusis, lateribus vix manifeste sinuatis; elytris minus fortiter sat crebre æqualiter (sed apicem versus magis crebre magis subtiliter) punctulatis —puncturis quam *P. obsoletæ*, Marsh., subtilioribus et paullo crebrioribus—interstitiis omnino planis. Long. 5, lat. $3\frac{4}{5}$ lines.

This is one of the very few species of *Paropsis* having the anterior angles of the prothorax mucronate and the disc of the elytra entirely devoid of verrucæ or convex interstices. In this respect (and in others) it is allied to *P. pictipes*, Chp., in which, however, *inter alia* the sculpture of the whole upper surface is very much coarser. The slight sinuation of the sides of the prothorax in the type is very likely to be merely an aberration of the individual, and is very different from the well marked median sinuation or notch that is so conspicuous in the species that I have associated together, as possessing that character, in the tabulation.

N. Queensland.

P. THYONE, sp.nov.

♀. Ovata; nitida; fortiter convexa (e latere visa fere ut *P. obsoleta*, Marsh., conformata); capite pronoto elytrorumque lateribus rufo-umbratis, elytrorum puncturis nigris; capite sat crebre subtiliter punctulato; antennis quam corporis dimidium paullo brevioribus; prothorace quam longiori ut 5 ad 2 latiori, in disco ut caput (ad latera nullo modo grosse) punctulato, utrinque latera versus profunde foveolato angulis anticis vix mucronatis posticis rotundatis, lateribus parum arcuatis obsolete sinuatis; elytris minus fortiter minus crebre parum æqualiter (fere ut *P. obsoletæ*, Marsh., sed magis subtiliter) punctulatis, interstitiis omnino planis. Long. 3½, lat. 2½ lines.

This is an anomalous species, as its prothorax shows only very slightly the characters that I have regarded as distinctive of Group i., and hence forms a transition to Group ii.; the lateral outline, however, is certainly not evenly arched, though its sinuation is very slight and the front angles can scarcely be called mucronate. In *P. irrorata*, Chp., the lateral outline of the prothorax is very little more sinuate. This species differs from most of the others in the group by its elytra entirely without elevated discal interstices. Among its immediate allies the extreme fineness of the discal puncturation of its pronotum is approached only in *P. Sospita*, Blackb., which differs from it *inter alia* by the evidently mucronate front angles of its prothorax and by the considerably closer and more evenly spaced discal puncturation

I have some specimens taken in the neighbourhood of Charters Towers (N. Queensland) which I hesitate to separate specifically from *P. Thyone*, although the elytral punctures are distinctly finer than in the type, but I can find no other difference. In some (but not all) of them the indefinite reddish markings on the pronotum are dark brown rather than red, and are better defined than in the type, appearing as a median V with two sinuous longitudinal lines on each side of it. In one of them the punctures on the elytra are (not black but) coloured as the derm.

N.W. Australia.

P. ÆGROTA, Boisd.

Baly gives this name, with doubt, as a synonym of the insect which he calls *lutea*, Marsh., and under that name describes very fully and well. But it is not *lutea*, Marsh., (as I shall show below). That it is *ægrota*, Boisd., is scarcely doubtful, as its characters are so well marked that even Boisduval's few words of description could hardly apply to any other *Paropsis*. It is widely distributed and common in N.S. Wales, Victoria, and Tasmania.

P. LUTEA, Marsh.

Through the courtesy of Mr. Masters I have been able to examine the type specimen of this insect. It is beyond doubt the species which Baly described under the name *consimilis*. I conjecture that it is also identical with *morbillosa*, Boisd. It seems to be widely distributed, as I have specimens from N.S. Wales and S. Australia.

P. RUBIDIPES, sp.nov.

♀. Ovata; minus lata; minus nitida; sat convexa (e latere visa ut *P. reticulata*, Marsh.. conformata); rufotestacea vel ferruginea, corpore subtus pedibusque rubris, antennis apicem versus infuscatis; capite inæqualiter vix crebre punctulato; antennis quam corporis dimidium sublongioribus; prothorace quam longiori ut 7 ad 3 latiori, rugulose subgrosse subacervatim (fere ut *P. ægrotæ*, Boisd.) punctulato, utrinque latera versus impresso, lateribus profunde 2-emarginatis, angulis posticis fere nullis; elytris crebre fortiter sat æqualiter punctulatis, interstitiis sat crebre granuliformibus. Long. $5\frac{1}{2}$, lat. 4 lines.

Remarkably like *P. reticulata*, Marsh., in respect of form and proportions, but differing widely from that species by the strongly bi-emarginate sides of its prothorax, the considerably closer puncturation of its pronotum, and the puncturation of its elytra much less obscured by their verrucosity. The bright red colour of the under surface is perhaps not an invariable character, but it is very conspicuous in the two specimens before me. This species is somewhat close to *P. variegata*, Blackb., also, but differs considerably in colouring, also in the puncturation of the pronotum (as specified in the tabulation), and also has closer elytral puncturation, so that the raised interstices of the punctures are notably smaller, making the elytra appear less coarsely sculptured.

Tasmania.

P. LATONA, sp.nov.

♀. Præcedenti (*P. rubidipedi*) valde affinis; multo magis convexa (e latere visa quam *P. lutea*, Marsh., paullo magis convexa, parte altiori paullo magis antice sita); corpore subtus (sternis plus minusve infuscatis) pedibusque testaceis, antennis nullo modo infuscatis; capite minus fortiter punctulato; prothorace paullo minus transverso; cetera ut *P. rubidipes*. Long. $5\frac{4}{5}$, lat. $4\frac{1}{5}$ lines.

Not unlike *P. convexa*, Blackb., in form, but *inter alia* with the pronotum very differently punctured.

W. Australia; Albany (sent by Mr. Masters).

P. BLANDINA, sp.nov.

♀. Ovata; sat nitida; sat convexa (e latere visa quam *P. carnosa*, Baly, paullo minus convexa); rufo-testacea, capite pronoti lateribus et elytris plus minusve flavo-marmoratis; capite crebre subtilius punctulato; antennis quam corporis dimidium parum brevioribus; prothorace quam longiori duplo latiori, in disco sat æqualiter sparsius vix fortiter nullo modo rugulose (ad latera grosse rugulose) punctulato, utrinque latera versus late profunde impresso, lateribus ante medium profunde 2-emarginatis, angulis posticis fere nullis; elytris fortiter sat crebre (quam *P. carnosæ*, Baly, vix minus crebre) punctulatis, interstitiis subæqualiter sat fortiter (fere ut *P. carnosæ* sed paullo minus fortiter) verrucosis. Long. 4½, lat. 3½ lines.

In most respects resembling *P. carnosa*, Baly, but with the disc of the pronotum distinctly less closely, much more finely and not at all rugulosely punctured and very much more nitid, and the sides of the pronotum bearing a large and deep (but not sharply limited) impression, the general form a little less strongly convex, and the verrucæ of the elytra somewhat less coarse and close, so that they do not so much obscure the puncturation. Compared with *convexa*, Blackb., this species is very much less convex (viewed from the side), with the discal puncturation of its pronotum very much less close and its elytral verrucæ very much less obscuring the puncturation. The very nitid surface of its pronotum, which is due to the absolutely non-rugulose and comparatively sparse character of the puncturation, distinguishes it I think from all its near allies.

W. Australia; taken by Mr. E. Meyrick.

P. POROSA, Er.

The form of the prosternum in this species is liable to a certain variation. In some specimens the sulcation of its hinder portion continues forward to much beyond the middle of its length, but even in those specimens the convex front part is longer than in the species having their prosternum of the normal form.

P. CASSIOPE, sp.nov.

♀. Ovata; sat nitida; minus convexa (e latere visa quam *P. irrorata*, Chp., vix magis convexa); pallide flavo-testacea, elytrorum puncturis nonnullis (his in parte laterali positis) nigris; capite crebre subtilius punctulato; antennis quam corporis dimidium vix brevioribus; prothorace quam longiori ut 11 ad 5 latiori, in disco ut caput (ad latera grosse vix confluenter) punctulato, utrinque latera versus late profunde impresso, lateribus leviter bisinuatis, angulis posticis rotundatis; elytris subfortiter minus crebre (quam *P. irroratæ*, Chp., paullo magis fortiter, sat multo minus crebre) punctulatis, interstitiis nonnullis leviter verruciformibus; prosterno inter coxas haud sulcato. Long. 4, lat. 3 lines.

The non-sulcate prosternum separates this species from all others of the group except *porosa*, Er., with which it certainly does not seem allied in any other respect. Nor do I believe that the absence of the prosternal sulcus is a constant character. If I am right in this opinion, specimens in which the sulcus is present must be placed in my tabulation beside *irrorata*, Chp., (where the species seems much more at home). It is very distinct from *irrorata* by *inter alia* the less close and evidently stronger puncturation of its elytra, which on the front part of the subsutural region is *very much* less close.

W. Australia.

GROUP II.

This small aggregate consists of species that agree in the puncturation of their elytra being non-seriate and the lateral outline of their prothorax non-sinuous, but whose great diversity in respect of other characters shows them to be an accidental assemblage of aberrant forms of *Paropsis*. Some of them are among the least, others among the most, strongly convex species of the genus; some among the most brightly coloured, some among the most obscure; some among the most, some among the least, strongly sculptured.

Twenty-eight names seem to be all that have been applied to members of this group (*P. perplexa*, Chp., being excluded as I have already—P.L.S.N S.W. 1897, p. 186—dealt with it as having been wrongly referred hither by its author). Of these only two appear to be synonyms (viz., *Atropos*, Stäl, and *biplagiata*, Bohem., apparently synonyms of *immaculata*, Marsh.). There are seven species (*suspiciosa*, Baly, *pedestris*, Chp , *globata*, Chp., *rubeola*, Chp., *subovalis*, Chp., *oblonga*, Chp., and *foraminosa*, Chp.) which I am satisfied that I have not seen, and which are not sufficiently described to allow of my placing them in my tabulation of the group.

There thus remain nineteen already described species known to me, and to these I have to add six new species, making twenty-five, which will be found characterised in the following tabulation.

As far as my observation goes this group contains an unusually large proportion of rare species—indeed, I know of only one (*P. immaculata*, Marsh.) which can be called common and somewhat widely distributed. These insects are for the most part of firm texture and but little liable to change in form or colour after death. *P. immaculata*, Marsh., is the only one that I have found to be subject to much variation. Many of the species are more or less brightly coloured. It will be observed that in the tabulation of this group I have made a good deal of use of colour and markings as furnishing specific characters. I have done so because by that means I am able to include in the tabulation several species not known to me in nature, and which otherwise I should have had to omit; but I have satisfied myself that the species in question are not at all likely to be variable in respect of the particular characters of colour that I have made use of :—

A. Elytra with coarse confused punctures interrupted on a large common area.
  B. Colour metallic brassy .... *æraria*, Chp.
  BB. Colour not metallic.
    C. Form viewed from the side but little convex (almost as in *P. intacta*, Newm.) .... *picea*, Oliv.
    CC. Form decidedly more convex.
      D. External half of elytra more or less closely and evenly punctulate (more or less as in *picea*)... *immaculata*, Marsh.
      DD. External half of elytra very sparsely and irregularly punctulate.............. .... *semipunctata*, Chp.
AA. Elytra with confused punctures interrupted on raised spaces of colour different from that of the derm.
  B. Elytra with regular rows of isolated raised spaces *Echo*, Blackb.

BB. The raised spaces on the elytra not seriate...... *anomala*, Blackb.

AAA. The interruption (if any) of the elytral puncturation neither raised blotches nor a single common area.

B. Disc of elytra with a sharply defined coloured pattern.

C. The elytral markings consist of numerous small spots paler than the general surface.

D. Pronotum with numerous black spots (size large, 5 lines long or more) .... *fulvoguttata*, Baly.

DD. Pronotum not variegated with black (size much smaller).. .... *Polyxo*, Blackb.

CC. The elytral markings consist of smoky brown or blackish areas longitudinally alternated with testaceous.

D. The testaceous areas are 5 narrow vittæ (of which 4 reach the base of the elytra)...... *bipuncticollis*, Chp.

DD. The discal testaceous blotches on the elytra are of irregular form, and do not reach the base.................................. ... . *umbrata*, Chp. (?)

CCC. The elytral markings not as in the preceding aggregates.

D. The pronotum without markings.............. *Stäli*, Chp.

DD. The pronotum marked with well defined black spots.

E. The elytral markings consist of more or less abbreviated longitudinal black lines *nitidissima*, Blackb.

EE. The black portions of the elytra more or less transverse.

F. The elytral markings include a black V *hastata*, Chp.

FF. No elytral marking resembling a black V .... *Selene*, Blackb.

BB. Elytra without any well defined discal pattern.

C. Legs with a sharply defined pattern of contrasted black and yellow (size large, long. 5½ lines or more)..... .... *Circe*, Stäl.

CC. Legs unicolorous or nearly so, or merely with femora somewhat darker than tibiæ.

D. Form not nearly convex enough for the outline (viewed from the side) to be a semicircle.

E. Elytral puncturation strong (not less so than in *bipuncticollis*, Chp.).

F. Elytral puncturation quite coarse, interstices distinctly convex.................. *Philomela*, Blackb.

FF. Elytral puncturation by no means coarse, interstices flat.

G. Form (viewed from the side) fully as convex as in *immaculata*, Marsh.

H. Disc of pronotum extremely closely and evenly punctulate............. *Waterhousei*, Baly.

HH. Disc of pronotum very much less closely and evenly punctulate *contracta*, Chp.

GG. Form (viewed from the side) much less convex .... *conjungens*, Blackb.

EE. Elytral puncturation notably less strong.

F. Elytra unicolorous or nearly so (except suture tending to be dark).

G. Ventral segments unicolorous or nearly so .... *palmensis*, Blackb.

GG. Ventral segments variegated with testaceous and black in strong contrast .... *abdominalis*, Chp.

FF. Elytra with conspicuous (though not sharply defined) smoky-black blotches...................... .... *semifumata*, Blackb.

DD. Form so strongly convex that the curved outline (viewed from the side) is at least a semicircle.

E. Disc of pronotum all but punctureless..... *mimula*, Blackb.

EE. Disc of pronotum closely and evenly punctulate.

F. Suture concolorous with the general surface.............. .... *hemisphærica*, Chp.

FF. Suture black................. .... *globulosa*, Chp.

P. ÆRARIA, Chp.

I have not seen an authentic type of this species, but have before me two female specimens from the neighbourhood cited as its habitat which agree perfectly with the description. A male *Paropsis* (also from tropical Queensland) in my collection is probably conspecific, but may possibly be distinct; the colour is less distinctly greenish, and there are scarcely any punctures on the elytra except on the extra-discal portion, so that the common scarcely punctured space includes nearly the whole elytra.

P. IMMACULATA, Marsh.

Dr. Chapuis considered this name a synonym of *picea*, Oliv., but I cannot agree with him. He does not say that he has seen the type of *picea*, and I have before me specimens that agree very well with Olivier's description, and with which *immaculata* is certainly not identical. These specimens (which are females) are distinctly larger than females of *immaculata* (of which I have an example that has been compared with the type specimen), and are much less convex longitudinally (*i.e.*, viewed from the side). If they do not represent *picea*, Oliv., they are an undescribed species, but I should not be justified in giving them a new name, as I could not specify any definite character to separate them from *picea*. It is true that Olivier calls *picea* "hemisphærica," but having regard to that author's use of the term for other *Paropses* I do not think that it connotes more than that the insect is somewhat circular in form and is convex absolutely (not necessarily as compared with other *Paropses*, of which Olivier apparently had only a few before him).

According to Chapuis, *P. Atropos*, Stäl, and *biplagiata*, Bohem., are also synonyms of *picea*, Oliv. As regards *Atropos* the description is so insufficient that it is only with hesitation one can say that it refers to either *picea* or *immaculata*, and to decide which of them it refers to is hopeless without inspection of the type; but the point is not an important one, as both those names are anterior to *Atropos*. *Biplagiata* is an easily recognisable insect which in my opinion is rightly regarded as a variety of *immaculata*.

P. ECHO, sp.nov.

♀. Late ovata; sat convexa (e latere visa quam *P. semipunctata*, Chp., paullo minus convexa); minus nitida; rufo-brunnea, testaceo piceoque variegata; capite inæquali, subtilius crebre punctulato; antennis quam corporis dimidium sat brevioribus;

fortiter (postice sparsius subtilius, ad latera grosse rugulose) punctulato, subinæquali, lateribus sat fortiter arcuatis, angulis posticis nullis ; elytris crebre subfortiter confuse punctulatis, verrucas sat magnas leviter elevatas testaceas sparsissime punctulatas (his longitudinaliter 10-seriatim dispositis) ferentibus. Long. 5, lat. 4 lines.

This species is distinct from its congeners of the same group by the presence on its elytra of regular rows of comparatively large well defined verrucæ. The subscutellar row is very short; the 2nd almost entire, interrupted near the middle and containing about 8 verrucæ; the 3rd entire and containing about 15 verrucæ; the 4th much interrupted, of about six verrucæ; the 5th, 6th, 7th, 9th and 10th much like the 3rd; the 8th much like the 4th. The ground colour of the upper surface is red-brown, the pronotum with 3 feebly marked piceous vittæ, the margins and verrucæ of the elytra testaceous. The under surface is obscure testaceous with the metasternum piceous in the middle; the legs are testaceous.

N. Queensland.

P. ANOMALA, sp.nov.

♂. Subcircularis; parum convexa (e latere visa quam *P. morio*, Fab., vix magis convexa); sat nitida; rufa, flavo piceoque variegata; capite crebre subtilius punctulato; antennis quam corporis dimidium paullo brevioribus ; prothorace quam longiori ut 16 ad 7 latiori, quam caput in disco (ad latera grosse nec confluenter), paullo fortius sparsius punctulato, utrinque latera versus late profunde impresso, lateribus sat arcuatis, angulis posticis rotundatis; elytris fere ut pronotum (sed minus crebre) confuse punctulatis, areis magnis late flavis lævibus ornatis his (aliis elongatis, aliis circularibus) leviter elevatis et puncturis lineatim confertim dispositis marginatis. Long. $5\frac{3}{5}$, lat. $4\frac{3}{5}$ lines.

The style of markings on the elytra of this species distinguishes it at once from all other *Paropses* known to me. The markings consist of large (and small intermingled with them) bright yellow unpunctured spaces, most of which are outlined on all their margins by a very conspicuous row of very closely placed punctures, and are raised above the general surface. The extremely intricate disposition of colours is difficult to describe clearly. The head and pronotum are yellow, with the sutures and margins narrowly red. On the head is a large piceous blotch (shaped like the letter M) standing on the clypeal suture, and there is another very similar blotch (but much larger) standing on the base of the pronotum, while a large piceous blotch shading off into reddish lies on either side somewhat within the lateral margin. The scutellum is yellow. The faintly raised yellow blotches are as follows on each elytron (exclusive of some blotches which are neither raised nor margined):—4 along the base running hindward (the middle 2 much shorter than the others); a large V with its angle close to the sutural apex, one of its extremities near the lateral margin about its middle, and the other extremity near the suture considerably behind its middle; 2 much smaller spots within the V; and 3 placed (of which one is very elongate-oval and placed longitudinally near the suture, one much shorter but oval and placed somewhat farther from the suture and nearer the front of the elytra, and one nearly round placed still farther from the suture and opposite the middle of the first named of these 3 blotches) in the space between the basal blotches and the V. Of the yellow markings on the elytra those which are not raised or outlined by a row of punctures are 2 spots close to the base, one near the middle of the lateral margin and the whole of the lateral margin itself. The suture also is faintly yellow. On the under surface and legs red and yellow shade off into each other very intricately. The antennæ are yellowish at the base, becoming piceous towards the apex. The colour of the punctured portions of the elytra is red-brown.

N.S. Wales (Rope's Creek). In Mr. Masters' collection.

P. Polyxo, sp.nov.

♂. Ovata; modice convexa; nitida; testacea, elytris nonnihil rufescentibus plagis (his haud elevatis) albidis ornatis, antennis apicem versus infuscatis; capite prothoraceque subtiliter sat crebre punctulatis; hoc ad latera magis fortiter punctulato, quam longiori fere ut 14 ad 5 latiori, a basi ad apicem modice subarcuatim angustato, utrinque latera versus impresso, angulis posticis obtusis; elytris sparsius sat subtiliter (quam prothorax multo minus subtiliter) confuse punctulatis. Long. 4, lat. 3 lines (vix).

A species of very pallid "washed out" appearance. I know no other *Paropsis* in the least resembling it in colour and markings. The elytra are of a pale reddish-testaceous colour, bearing numerous sharply defined (but owing to the pallor of the ground colour, not very conspicuous) round whitish spots which differ much *inter se* in size. These are arranged as follows:—A row of about 10 spots near the suture and a similar row near the lateral margin; another somewhat similar row (but with only about 6 spots owing to a wide gap in front of the middle) about the middle of the disc; a single large spot between the last-mentioned row and the submarginal one. The lateral margin of the elytra is very pale testaceous. The antennæ are scarcely half as long as the body. I have both sexes before me. The female scarcely differs from the male externally except by the usual tarsal distinction and its slightly more convex form.

N.S. Wales; Richmond River (Mr. Lea).

P. SELENE, sp.nov.

♀. Subcircularis; valde convexa (e latere visa quam *P. Circe*, Stål, vix minus convexa); nitida; nigra, capite obscure rufo-notato, prothorace rufo (hoc nigro-notato), elytris rufo-notatis, antennarum basi rufa; capite leviter minus crebre punctulato; prothorace quam longiori ut 13 ad 6 latiori, in disco fere lævi, ad latera subfortiter nec confluenter punctulato, lateribus subrectis a basi ad apicem sat fortiter convergentibus, angulis posticis obtusis; elytris in disco subtiliter sparsius confuse (in parte laterali grosse) punctulatis. Long. 4, lat. $3\frac{3}{5}$ lines.

The extremely strong contrast between the very coarse puncturation of the lateral margins and the very fine puncturation of the rest of the surface of the elytra furnishes a good character in this species. The black markings of the pronotum consist of two large spots placed transversely on the disc. The red markings on the elytra are: the strongly punctured marginal part, which at the sutural apex gives off a vitta; this vitta, which at first bends away from the suture and then runs parallel with the suture (at a little distance from it to considerably beyond the middle of the elytra) and there turns abruptly outward, ending in a dilatation partly encircling the scarcely defined humeral callus; a curved fascia which leaves the lateral red stripe somewhat behind its middle and runs obliquely hindward to join the subsutural vitta somewhat in front of its apex (the two vittæ and their connecting fascia thus enclosing a black blotch near the apex of the elytra). The antennæ of the type are broken, but I judge them to have been when entire about one-half the length of the body. The colouring and markings of this species are suggestive of species in Group v. (*P. beata*, *mera*, *octomaculata*, &c.), from which its very much more convex form and non-seriate elytral puncturation at once distinguish it.

N. Queensland; sent by Mr. Masters.

P. PHILOMELA, sp.nov.

♂. Sat late ovata; minus convexa (e latere visa quam *P. immaculata*, Marsh., vix minus convexa); nigra, supra (capite posticescutelloque nigris exceptis) brunneo-testaceo, elytrorum parte laterali dilutiori, antennis basin versus tibiis tarsisque plus minusve rufescentibus; capite confertim subtilius punctulato; antennis quam corporis dimidium parum longioribus; prothorace quam longiori ut 5 ad 2 latiori, in disco confertim subtilius (ad latera grosse vermiculatim) punctulato, utrinque latera versus late indeterminate impresso, lateribus sat arcuatis, angulis posticis rotundatis; elytris confuse fortiter rugulose sat crebre minus æqualiter (fere ut *P. maculatæ*, Marsh., sed sine verrucis definitis), punctulatis; prosterno inter coxas haud (vel in parte postica sola) sulcato. Long. 5, lat. 4 lines.

This species is readily recognisable among those of the present Group by the coarseness and rugulosity of its elytral sculpture. The convex interstices of the punctures are of various sizes and dispositions, but they are not of the isolated character that would entitle them to be called verrucæ.

Tasmania (Mr. A. Simson).

P. SEMIFUMATA, sp.nov.

♂. Ovata; sat nitida; minus convexa (e latere visa quam *P. immaculata*, Marsh., multo minus convexa); rufo-testacea, elytris pallide brunneo-testaceis (his plagis fumicoloribus et puncturis nigricantibus indeterminate ornatis), antennis apicem versus infuscatis; capite subtilius confertim vix subaspere punctulato; antennis quam corporis dimidium brevioribus; prothorace quam longiori paullo magis quam duplo latiori, in disco subtilius inæqualiter subacervatim (ad latera grosse subconfluenter) punctulato, lateribus leviter arcuatis, angulis posticis superne visis subrectis; elytris confuse subtilius minus crebre (fere ut *P. hemisphærica*, Chp.) punctulatis, areis lævibus nonnullis longitudinalibus irregularibus ornatis, interstitiis subtilissime vix (parte laterali grosse inæqualiter) punctulatis. Long. $3\frac{1}{8}$-$3\frac{4}{5}$, lat. $2\frac{1}{8}$-$2\frac{3}{8}$ lines.

♀. Antennis paullo brevioribus.

This species is notable among its allies by the presence on the elytra of feebly defined unpunctured spaces of an unusual shape. When present these spaces are usually in the form of distinct continuous vittæ, but in the present insect they are somewhat oblong and very indistinctly limited spaces so placed as to look like detached pieces of vittæ.

N.S. Wales (Lea, &c.; taken at Richmond River, &c.).

APPENDIX.

P. EXCISIPENNIS, sp.nov. Sat late ovalis; sat convexa; minus nitida; pallide testacea, elytris pone medium in disco indeterminate sanguineo-tinctis; capite dupliciter (crebre sat fortiter et crebre subtilissime) punctulato; prothorace quam

longiori ut 7 ad 3 latiori, fere ut caput (sed ad latera multo magis grosse et hic impresso) punctulato; elytris ad latera ter emarginatis (partium emarginatarum finibus obtuse angulatis), subseriatim (serierum numero circiter 20) fortiter punctulatis; antennis brevibus, apicem versus sat compressis; prosterno inter coxas longitudinaliter leviter impresso. Long. 2¼, lat. 1⅗ lines.

This remarkable *Paropsis* differs from all others known to me by the peculiar outline of its elytra. This is laterally prominent immediately behind the shoulder, then concave to about the end of the front one-third of the whole outline, where it is obtusely angularly prominent, then concave again to somewhat beyond the middle of the whole outline, where it is again angularly prominent, then slightly concave to the apex. Although the puncturation of the elytra is far from being regularly seriate throughout, it is so on the greater part of the disc, and therefore this species ought to be placed (since its elytra are non-verrucose) in my Group iv. (and also it falls in Chapuis' Groupe iv., although the characters of that group are not altogether identical with those of my Group iv.). In my subdivision of Group iv. (P.L.S.N.S.W. 1896, p. 643) it must be referred to Subgroup i., from all the previously described members of which it differs by the "strongly marked character" (placing it in the subgroup) being the remarkable outline of the elytra.

W. Australia.

ERRATUM.

P.L.S.N.S.W. 1896, p. 640, line 3—*For* perparvula, Chp., *read* perparvula, Clk.

[Printed off August 5th, 1901.]

NOTES ON THE BOTANY OF THE INTERIOR OF NEW SOUTH WALES.

By R. H. Cambage, L.S.

Part III.

(Plate xii.)

The following notes refer to the country extending from Mudall Station, on the Bogan River, to Euabalong, on the Lachlan:—

Soon after leaving the river some of the West Bogan scrub clearing is noticed, and it is found that most of the White or Cypress Pine, *Callitris robusta*, has been destroyed by ring-barking. It seems very doubtful whether this is a wise action, as there is apparently no timber left to adequately take its place. The result of several years of enquiry has led me to believe that if a vote were taken throughout the western district as to which is the most all round useful timber there, the verdict would be in favour of Cypress Pine; though at the same time there are settlers who destroy it for fear of scrubs being formed by the seedlings. Unfortunately it covers large tracts of country between the Bogan and the Lachlan, much to the injury of the sheep-breeder, for not only does it prevent the growth of grasses, but affords shelter for vermin. Still it does not by any means become a nuisance everywhere it grows, and it is questionable whether in some instances it would not be better to give up certain areas solely to the Pine for the sake of the timber, as these areas are often almost useless for sheep. There is one quality which this tree has to commend it, and that is, it does not throw out suckers no matter at what stage it is cut down or ring-barked, so that it is only in respect of quantity from seedlings that it is considered a nuisance. It extends over a very large area, preferring the dry soil and avoiding the damp river flats. It comes eastward till it reaches an elevation of about 1,500 feet above sea level, when it ceases, though it is seldom plentiful above 1,200 feet. The timber is used freely for fence posts and all kinds of buildings. It seems to resist the white ants better than the Box timbers; but Mr. Coles, of Gilgunnia, informs me that if a tree be ring-barked and allowed to stand till dead, it is soon attacked if then cut down and used; but if cut down green and allowed to season while in a horizontal position, it offers much more resistance. The theory advanced for this is, that the incisions made by ringbarking afford a ready escape for the product which is required to keep away the white ants, and the downflow is assisted by the vertical position of the trees. I give these particulars, as any information on the subject is useful; and if the treatment should be found reliable it might possibly be of service in connection with the attacks of the Teredo on the coast Turpentine, *Syncarpia laurifolia.* As a firewood White Pine is not prized, because it burns so rapidly. When first lighted it shows some similarity to Budtha, *Eremophila Mitchelli*, as both burn with considerable splutter, and both are objectionable because they cover everything with soot that comes within range of the fire. In other respects the trees are quite dissimilar. It might be mentioned that there is scarcely any western tree which does not make good burning wood, but perhaps the favourites for cleanliness and slow burning are Myall and Yarran; while north of Cobar, where Myall does not grow, *Acacia excelsa* (Ironwood) is considered one of the best in these respects.

Between Mudall and Pangee Homesteads the following trees and shrubs were noticed:—*Geijera parviflora* (Wilga), *Pimelia microcephala*, *Eremophila maculata* (Wild Fuchsia), *E. Mitchelli* (Budtha), *Sterculia diversifolia* (Currajong), *Casuarina Cambagei* (Belah), *Pittosporum phillyræoides*, *Myoporum deserti* (Dogwood), *Hakea leucoptera* (Needlewood), *Dodonæa* sp. (Hopbush), *Canthium oleifolium*, *Heterodendron oleæfolium* (Rosewood), *Apophyllum anomalum* (Currant or Emubush), *Fusanus acuminatus* (Quandong), *Callitris robusta*, *Capparis Mitchelli* (Wild Orange), *Exocarpus aphylla.*

Flindersia maculosa (Leopard Tree) and *Atalaya hemiglauca* (Whitewood) are to be seen near Mullengudgery, on the railway line, to the north of Mudall, which seems about their southern limit, though they may possibly extend down the Darling River.

The Acacias are represented by *A. Oswaldi* (Miljee or Dead Finish), *A. dealbata* (green variety), and *A. homalophylla* (Yarran). Just at starting, and near the river, *A. pendula* (Myall or Boree) is fairly plentiful, and has been more so; but in travelling from this point to the Lachlan viâ Nymagee, it is not seen again until that river is reached, a distance by road of about 150 miles To a Bogan River man the knowledge of this fact would at once convey the impression, which is correct, that the country lying between the Bogan and Lachlan Rivers along this route is not made up of river plains, but is inclined to be scrubby, hilly and dry. The country lying to the west of this road is of the same nature, with no natural water conservation. Before the days of squatters and Government tanks, and in times of drought I do not think any water could have been obtained between Bourke and Condobolin viâ Cobar and Nymagee, except immediately after a thunderstorm. The aborigines were assisted in their journeys across this class of country by obtaining water from the lateral roots of the Mallees, as mentioned by previous writers. The species from which the chief supply was obtained is the Red Mallee, *Eucalyptus oleosa*. In South Australia this tree is sometimes called Water Mallee because the roots yield a considerable quantity of water. These roots were cut into lengths, and stood on end; the water would then at once begin to drip out in exactly the same way as it does from the large vines known as Supple Jack, which are found in the coast brushes. For the information of those who have not had any experience in drinking from these vines, it may be mentioned that after selecting one about three inches in diameter it is not sufficient to simply cut it in one place, as then only a little moisture would appear, but it is necessary to make an incision above, or better still, to cut a length of two or three feet right out. A bushman holds this up and allows the water to flow straight into his mouth, so as to

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oleifolium, *Heterodendron oleæfolium* (Rosew
anomalum (Currant or Emubush), *Fusanus*
dong), *Callitris robusta*, *Capparis Mitchelli* (
carpus aphylla.

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avoid noticing the woody taste which is in evidence if the water is collected in a vessel and allowed to stand.

Mr. Surveyor E. A. Harris informs me that in the dry country back from the Murray River the wild pigs break up the roots of the Mallee, which are apparently their chief water supply.

At about 20 miles north of Mudall, and a few miles south of Nyngan, is a clump of *Acacia harpophylla* (Brigalow), noticed in 1892.

The Eucalypts noticed were *E. largiflorens*, *E. populifolia* (Bimble Box), *E. intertexta*, *E. Woollsiana*, *E. dumosa*, *E. oleosa*, and *E. rostrata* (River Red Gum).

E. largiflorens was seen near the Bogan, and not again until the Lachlan was reached.

E rostrata was not seen after leaving the Bogan, till it was found on a creek at Pangee Homestead.

From Pangee to Nymagee, a distance of about 28 miles westerly, there are:—*Callitris robusta*, *Exocarpus aphylla*, *Apophyllum anomalum*, *Eremophila Mitchelli*, *E. longifolia* (Emubush), *Hakea leucoptera*, *Helichrysum Cunninghamii*, *Geijera parviflora*, *Heterodendron oleæfolium*, *Capparis Mitchelli*, *Myoporum deserti*, *Canthium oleifolium*, *Cassia eremophila*, *Fusanus acuminatus*, *Celastrus Cunninghamii* (a shrub with small pink fruits and bitter leaves), *Bossiœa* sp. (without flowers), *Sterculia diversifolia*, *Beyeria vicosa*, and *Casuarina Cambagei*.

Heterodendron oleæfolium is known here and to the eastward, towards Dubbo, both as Rosewood and Whitewood, the confusion having probably arisen in the following manner:—North of Nyngan and around Bourke the tree known as Whitewood is *Atalaya hemiglauca;* and the wood, which is not extremely hard for a western timber, is white right through. It is seldom to be found to the south of Nyngan, but the other tree, *Heterodendron oleæfolium*, is, and in young trees the wood is all white, while the bark somewhat resembles that of *Atalaya hemiglauca*, which partly accounts for the confusion. In mature trees of *Heterodendron oleæfolium*, which reach a height of 40 feet, with a diameter of Rosewood, and it is exceedingly hard, though not tough. Near Nymagee I have known large trees of it called Ironwood, owing to the hardness of the wood. Through having white wood when young and red wood when mature, is another and probably the chief reason why the tree has the two names of Whitewood and Rosewood, for I found that on some holdings they are considered two species. On the Lachlan and about Trangie, on the western railway line, are places where it seems to attain its greatest size. The leaves are much in request for fodder, and if the branches be lopped, young shoots will grow freely, giving the tree a very pretty appearance, although generally it is by no means an umbrageous species. Between Bourke and Cobar it is seldom much more than a shrub, with pale glaucous leaves, and is one of the plants known as Blue Bush, though on Gundabooka Station I have heard it called Rose Bush as well. The species extends at least as far south as the Murrumbidgee, generally growing on good soil and avoiding rocky situations. Its aboriginal name on the Lachlan is Beernan, and towards the Bogan it is Ruba.

The Acacias noticed between Pangee and Nymagee were:—*A. homalophylla*, *A. Oswaldi*, *A. hakeoides*, *A. decora*, *A. doratoxylon* (Currawong), *A. colletioides* (Pin Bush), *A. Burkittii*, and *A. amblygona*, A. Cunn., a dwarf prickly species growing near Nymagee.

The Eucalypts seen were:—*E. rostrata*, only close to Pangee, *E. populifolia*, *E. Woollsiana*, *E. intertexta*, *E. oleosa*, *E. dumosa*, *E. viridis*, *E. sideroxylon*, *E. tereticornis*, var. *dealbata*, and one tree of Ironbark Box found on a slate ridge among *E. sideroxylon* and *E. Woollsiana*. The Ironbark Box is the tree which has the appearance of being a hybrid between *E. sideroxylon* the Ironbark, and *E. Woollsiana*, the Box. Just north of Nymagee is a hill of considerable geological interest, one side being Silurian slate, and the other a porphyry and granitic rock. On the slate side is *Eucalyptus Morrisii*, a mallee 8 or 10 feet high, but it is seldom found on the other side, where instead there is *E. terticornis*, var. *dealbata*. All through I have noticed that the former prefers a sedimentary formation, and the latter is strongly represented on an igneous, though they are not absolutely restricted to either. I have never seen *E. Morrisii* growing east of a line joining Girilambone, Nymagee, and Euabalong.

A few trees of *Acacia implexa*, Benth., (Hickory) were found on the top of the igneous hill. This is the most north-westerly locality in which I have found this species. It was next seen at a point about 80 miles south-easterly from Nymagee, towards Trundle, and here again it was on the top of a hill composed of igneous rock, a very fine granite, there being not more than half-a-dozen trees. The question suggested by the position of these isolated representatives of a species which is known to extend southerly through New South Wales and Victoria, is whether these trees have once been more plentiful in the north-west and have been reduced by geological and climatic agencies, or whether they are only now finding their way out in that direction. Judging from the surroundings I incline to the former suggestion, but the solution of the question seems full of interest to both botanists and geologists.

Casuarina quadrivalvis (Mountain or She Oak), with cones 2⅛ inches long, was also noticed on the igneous hills. Also *Exocarpus cupressiformis*, Labill., (Native Cherry), and now seen for the first time in coming from Bourke. Other trees growing around were *Eucalyptus sideroxylon* and *Acacia doratoxylon*. *Tecoma australis* (Bignonia) was found still flowering early in June. The aboriginal name for this climber is Geewong.

From Nymagee to Wirlong Copper Mine is about 15 miles south-westerly, and near the road the following trees and shrubs were noticed :—*Callitris robusta*, *Hakea leucoptera*, *Heterodendron oleæfolium*, *Apophyllum anomalum*, *Capparis Mitchelli*, *Geijera parviflora*, *Cassia eremophila*, *Dodonæa* sp., *Bertya Cunninghamii* (Broom Bush), *Fusanus acuminatus*, *Sterculia diversifolia*, *Eremophila Mitchelli*, *E. longifolia*, and *Eriostemon difformis*, A. Cunn., a shrub with short leaves and pretty white terminal flowers. Only a few flowers were found in June, but the plant attractive little shrub. After passing the six-mile gate there were *Pittosporum phillyrœoides*, *Exocarpus aphylla*, *Casuarina quadrivalvis*, *Melaleuca uncinata*, R.Br., (Tea Tree), *Canthium oleifolium* (at the 12-mile tank), *Casuarina Cambagei*, *Bossiœa* sp., *Triodia irritans*, R.Br., (Spinifex), and *Myoporum deserti.*

The Acacias included *A. Oswaldi*, *A. hakeoides*, *A. homalophylla*, *A. Burkittii*, *A. decora*, *A. calamifolia*, Sweet, *A. doratoxylon*, *A. aneura* (Mulga), and a very little of a plant like *A. undulifolia*, Frazer, but as neither flowers nor pods were found it is impossible to speak with certainty.

A few trees of what is probably *A. rigens*, A. Cunn., were seen, but as only very young flowers were obtained the identification is not certain.

One tree of *Acacia aneura* was seen soon after leaving Nymagee, and half a dozen more at about 11 miles, so that the species is not very well represented in this locality.

A. calamifolia grows about here with one stem for only a few inches, then spreads into half a dozen with fairly smooth grey bark. Height up to 12 or 15 feet, and quite as broad across the top. The leaves are needle-shaped with slightly curved points. On first catching sight of the trees it is noticed that small bushes have much the appearance of *A. Burkittii*, but the latter always assumes more of a shrub-form with thin stems, growing in patches, and its appearance would suggest the name of Broom Bush.

The Eucalypts seen were *E. populifolia*, *E. intertexta*, *E. oleosa*, *E. dumosa*, *E. viridis*, *E. sideroxylon*, *E. Morrisii*, *E. tereticornis*, var. *dealbata*, *E. Woollsiana*, and *E. uncinata*. *E. sideroxylon* had not ceased flowering in the Nymagee district early in June. Around Nymagee *E. intertexta* is burnt considerably for charcoal, and seems to be the chief tree used for that purpose. It is known by some as Gum, and by others as Yellow Box.

Soon after passing the 12-mile tank a small patch of very narrow-leaved mallee was noticed, which upon investigation proved to be *Eucalyptus uncinata*, Turcz. The fruits were unusually small, but, together with the flowers, are otherwise identical with specimens recently collected in South Australia, and kindly identified for me by Mr. J. G. Luehmann, F.L.S., Curator of the National Herbarium, Melbourne. In a previous paper (Part i.) it was mentioned that only four species of mallee were noticed between Bourke and Condobolin, but the identification of *E. uncinata* makes five. The species probably extends to the south-west from the point where it has been found. It has not previously been recorded so far east in New South Wales, and appears to have been known to exist chiefly in the south-west corner of the State.

Owing to their narrow leaves, *E. uncinata* and *E. viridis* might easily be confused in the distance, but a comparison of fruits or flowers enables the observer to readily separate them. The fruits of the former are somewhat like those of *E. oleosa* on a small scale, and both have the peculiarity of holding part of the style in position long after the rest of the flower has fallen. The top of the style is eventually broken off; the split base still remaining is then seen as three or four protruding valves. But these two species would rarely be confused when seen growing, owing to the great difference in the size of their leaves, those of *E. oleosa* being large beside those of *E. uncinata.* In most Eucalypts the stamens stand out fairly straight when the flower is fully developed, but a characteristic of *E. uncinata* is that the filaments are slender, and seem too weak to straighten out, the alternative being that to a great extent they retain the angles which are formed before the anthers are released from the calyx.

The Wirlong Copper Mine is situated among some hills made up of slate and crushed porphyry, and growing around are *Casuarina quadrivalvis, Helichrysum Cunninghamii, Phebalium glandulosum, Eremophila latifolia, Eriostemon difformis, Cryptandra amara*, Sm., *Tecoma australis* with narrow leaves, *Beyeria viscosa, Eucalyptus sideroxylon, E. viridis, E. Morrisii*, and *E. tereticornis*, var. *dealbata.* This last-named tree grows here sometimes in mallee form, spreading out from one root into 8 or 10 [redacted]

An interesting shrub was found on the top of the highest hill to the north of the mine, and appears to be a variety of *Correa speciosa*, Andr. It bears whitish-green flowers half an inch long, each having four connate petals, giving the flower a tubular form. The eight stamens are arranged so that there is one extending along the centre of each petal, and one at each angle formed by their adhering edges, the internal appearance of the flower resembling a partially opened umbrella. This plant was never seen by me in any other part of the western district, though probably it is to be found there.

South of the mine, and along the south boundary of portion M.L.4, parish Jamieson, is an Acacia growing as little trees 8 or 10 feet high, with narrow viscid leaves No pods were to be seen, and the flowers, which were only just forming in June, appeared in their young state as almost sessile globular heads arranged in pairs. The plant was not met with again, and the incomplete specimens have not been identified.

Acacia amblygona was found on a hill to the south, and *A. excelsa* to the south-west.

From the Wirlong Copper Mine to Gilgunnia is about 20 miles in a general southerly direction, the formation consisting of alternate slate and porphyry hills, and lowland made up from the denudation of those elevations. The following trees and shrubs were noticed :—*Pittosporum phillyrœoides*, *Fusanus acuminatus*, *Casuarina Cambagei*, *C. quadrivalvis* (on a sandy ridge), *Callitris robusta*, *Geijera parviflora*, *Eremophila Mitchelli*, *E. longifolia*, *E. latifolia*, *Melaleuca* sp. (without flowers), *Eriostemon difformis*, *Apophyllum anomalum*, *Capparis Mitchelli*, *Hakea leucoptera*, *Heterodendron oleæfolium* (with rather pale leaves), *Exocarpus aphylla*, *Dodonæa viscosa*, var. *attenuata*, *Bertya Cunninghamii*, *Templetonia* sp. (without flowers), and *Sterculia diversifolia*.

The Belah hereabouts has green branchlets, and not that pale appearance commonly seen between Bourke and Cobar.

In this and many other places in the west there is a vine, *Lyonsia eucalyptifolia*, which almost covers some of the large trees, and in time kills them. I do not at present know whether this species produces yams like *Parsonsia Paddisoni*, Baker.

The Acacias seen were :—*A. dealbata* (green variety), *A. homalophylla*, *A. hakeoides*, *A. doratoxylon*, *A. Burkittii*, a few trees of *A. aneura*, *A. decora* (growing on the porphyry formation), *A. rigens* (?), and *A. Oswaldi* (locally known as Middy). At Dandaloo, on the Bogan, an aboriginal name for this tree is Currawawidgee. All through this district the Yarran is covered with a mistletoe, *Loranthus pendulus*, Sieb.

The Eucalypts noted were :—*E. Woollsiana*, *E. sideroxylon*, *E. tereticornis*, var. *dealbata*, *E. Morrisii*, *E. viridis*, *E. populifolia*, *E. oleosa*, *E. intertexta*, *E. dumosa*, and *E. rostrata*.

In travelling southerly and easterly from Gilgunnia *E. Morrisii* was never seen again.

The Ironbark (*E. sideroxylon*) continues as usual in the far west to be of rather crooked growth, and it is seldom possible to get more than one log from a single tree.

The only trees seen of the River Red Gum (*E. rostrata*) were along the banks of Sandy Creek, near a Government tank. The composition of the bed of this watercourse gives evidence that the stream takes its rise in hills of granite somewhere away to the westward. The fact of a Government tank being constructed within half a mile of this creek, and in no way connected with it for supply, demonstrates the fact that for the greater part of the year it is a creek without water, like most of the western watercourses. Early in May of 1899 I reached this spot one evening with thirsty horses only to find both creek and tank dry, which goes to prove that a Government tank is not always a guarantee of water, though as a matter of fact it generally is. On examining the River Gums it was found that although the leaves and mature fruits were typical, the buds showed a different operculum to the usual form, for instead of being pointed and pinched in the middle they tapered away evenly from the base to a rather blunt ending, and were shorter than usual, having much the appearance stand that this form is not actually rare, still I have only collected it on creeks, and have never noticed it on the trees growing near large rivers.

In travelling through this part of the country, it is not long before anyone interested in botany learns that the hills of sedimentary formation are much more prolific in botanical specimens than are those composed of igneous rocks.

Near Back Berdouba Station, about 6 miles north of Gilgunnia, is a hill apparently of porphyry rising a few hundred feet above the surrounding levels, and known as North Peak. The Eucalypts on it are confined to *E. populifolia* and *E. tereticornis*, var. *dealbata*, chiefly the latter, some of it growing as trees and some spreading as mallees. *Casuarina quadrivalvis* is also found near the top, with *Acacia doratoxylon*, *Sterculia diversifolia*, and *Canthium oleifolium;* while climbing over them is *Tecoma australis*. Just at the base of the hill there are *Callitris robusta* and *Acacia decora*. All the above, with the exception of *Canthium oleifolium*, may be expected on any porphyry hill throughout the Gilgunnia district. Most of these hills are, therefore, fairly clear, and generally they present a rounded form in the distance.

From Gilgunnia to Double Peak is about 23 miles southerly, the formation being slate for 5 or 6 miles after which it is chiefly weathered porphyry. *Callitris robusta* is to be found all the way, other trees and shrubs met with being :—*Eremophila Mitchelli*, *E. longifolia*, *E. latifolia*, *Hakea leucoptera*, *Casuarina Cambagei*, *Cassia eremophila*, *Apophyllum anomalum*, *Heterodendron oleæfolium*, *Geijera parviflora*, *Dodonæa* sp., *Exocarpus aphylla*, *Sterculia diversifolia*, *Eriostemon difformis*, and *Olearia decurrens*, A. Cunn.

The Acacias were represented by *A. homalophylla*, a little of *A. aneura*, *A. Oswaldi*, *A. decora*, *A. calamifolia*, *A. doratoxylon*, and *A. Burkittii*. Some few miles after leaving Gilgunnia a few trees of *Acacia excelsa* were seen, and this is the most southern point at which I have ever found the species, though it may continue to the south-west.

The Eucalypts observed were *E. oleosa*, *E. dumosa*, *E. populifolia*, *E. intertexta*, *E. viridis*, and *E. tereticornis*, var. *dealbata*. The latter is sometimes here called Applewood.

Mount Hope is about 10 miles south of Double Peak, and the vegetation between these towns is much the same as that passed through coming from Gilgunnia.

From Mount Hope to Euabalong is about 44 miles south-easterly, and up till two years ago there was no water to be had on the road between these places, and the stage had to be made in one day. This gave one very little time to examine the intervening country, consequently my notes are not as complete as I could wish.

Some trees noted were *Callitris robusta*, *Eucalyptus populifolia*, *E. viridis*, *E. intertexta*, and *E. uncinata;* the last of these has been only recently identified from some specimens which I had put away. The fruits in this case are of normal size.

From about the 15- to the 21-mile posts there is a Mallee scrub consisting chiefly of *E. oleosa*, and *E. dumosa*, while here and there through the scrub are trees of *E. sideroxylon* and *E. intertexta*. At about half-way to Euabalong is a ridge of sandstone and conglomerate, probably Devonian, though no fossils were found. From the foot of this elevation the mallee extends for many miles growing among the sand accumulated from the wearing away of the surrounding hills.

Just after passing the sandstone hill there is now a tank, and growing near is a fair quantity of Mulga, *Acacia aneura*, some with fairly broad and some with very narrow leaves. I have not seen this species east or south of this point, so that probably its south-easterly limit is not far from here.

Acacia homalophylla, *A. hakeoides*, and *A. triptera*, Benth., were noticed at different points along the road.

Apophyllum anomalum, *Tecoma australis*, *Casuarina Cambagei*, *Cardamine hirsuta*, Linn., and *Triodia irritans* were also noted.

Among the Mallee about here there is often a spreading Pine, *Callitris verrucosa*, R.Br., which grows with a short stem and those of *C. robusta*, and are covered with pimples or warts full of a resinous substance. South of the Lachlan this tree is sometimes called Turpentine.

On looking over my specimens I find that, at about 10 miles from Mount Hope, I collected a Mallee which so far has not been identified, and may possibly be undescribed. This makes six species of Mallee noticed along the road from Bourke to Condobolin. The leaves of this tree are narrow like those of *E. viridis*, or *E. uncinata*. The fruits are shaped somewhat similar to the large forms of *E. viridis*, but have the capsule deeply sunk. The buds have a short, nearly hemispherical operculum. I have collected the same species in the Ninety Mile Desert, South Australia, but in neither instance was I able to procure flowers.

Towards the Lachlan are some large trees of *Heterodendron oleæfolium*. Here *Eucalyptus largiflorens* is again found following the river country, also *E. rostrata*.

Another tree growing on the river flats is *Acacia salicina*, Lindl., (Cooba or Native Willow). It has a diameter up to two feet, and is a most useful timber, being in request for cabinet making and certain wheelwright's work Cooba appears to be the aboriginal name for this tree, but there is a growing tendency in the west to pronounce the name Cuba. There are other cases of this change, notably in *A. homalophylla*, now called Yarran, but by the aborigines pronounced Yarreen; and again in *A. Cambagei*, Baker, which is by the aborigines pronounced Gidgea or Gidya, but very often now called Gidgee. *A. salicina* has a considerable range, but is generally associated with river country. Its most eastern locality recorded is the Page and Hunter Rivers, east of Scone. This particular district, east of the Dividing Range, is interesting in being the home of several western species (already recorded by Messrs. Maiden and Betche); among others which may be seen from the road are *Acacia harpophylla*, (Brigalow); close to Scone, *A. homalophylla*, at Belltrees; *Heterodendron oleæfolium*, *Geijera parviflora*, and large trees of *Acacia salicina*, near the Page River. Probably a search through the hills would reveal several others. The rock here is the same as that west of the range, which tends to show that the geological formation is an important factor in the distribution of species. Near here the Great Dividing Range, with its cold heights, has not formed the usual barrier between the eastern and western floras, for the Liverpool Range is lower than, for instance, the New England Range, the Blue Mountains, or the Monaro Range, the highest point on the railway line being only a little over 2000 feet, as against 3000 and 4000 feet on the other ranges. Therefore climatic conditions have probably also assisted in the spread of these species.

Growing close to the bank of the Lachlan, near Euabalong, is a tree with rough bark and long narrow leaves, and often known as River Cooba to distinguish it from *A. salicina*, with which it is seen to have affinities. It is *A. stenophylla*, and follows the banks of the Lachlan for many miles, hanging over the water among the Red Gums.

E. melliodora, A. Cunn., Yellow Box, is now seen for the first time. Out in the west this tree is generally found near the rivers, though in the Bathurst and Orange districts it is also growing on the hills; and even north-west of Parkes it extends on to the hills south of the Bogan, though it is not so plentiful. Along the river flats it is a handsome shade-tree with a pendulous habit, and after being lopped often grows with increased beauty. Evidence of this may be seen near Cootamundra, where for years the leaves of this species have been used for the production of a well known brand of eucalyptus oil. The bark of this tree is sometimes smooth and white, while in other cases the trunk is covered with a brown flaky bark, and often in old trees it is quite rough near the butt. I have looked for some botanical difference between the rough- and the smooth-barked forms, but have failed to find any. Nor does this feature seem to be regulated by climatic conditions, as both kinds are found on the banks of the Lachlan in a warm climate, and again on the cold hills around Orange.

E. melliodora gives a good timber, especially for posts, and difficult to split, it is for these reasons often left alone. In general it is not a tall tree, considering the diameter of the trunk, which is often four or five feet. One constant feature of this species is that the sap is yellow, and this is always the bushman's test in cases of doubt, the investigation being effected by removing a piece of the bark. It is this yellow sap that gives rise to the names of Yellow Box and Yellow Jacket.

Its flowers are rich in honey, as might be supposed from its botanical name. It may not be generally known that in some of the cold parts near Bathurst it sometimes becomes necessary for the apiarist to travel his bees for flowers in much the same way as the squatter has to travel his sheep for grass, and partly because certain species of Eucalypts do not flower profusely every year, but generally miss a year, and sometimes more. In such cases a patch of flowering Yellow Box is sought, as this tree gives the best results to the bee farmer. Next to this the White Box, *E. albens*, is considered one of the best for honey.

E. melliodora has a wide distribution, but is much more plentiful west of the Great Dividing Range than east of it, growing on both igneous and sedimentary formations, though it is rare on the Triassic.

In the Campbelltown and Illawarra districts *E. Bosistoana*, F.v.M , is sometimes called Yellow Box, the local assumption in some cases being that it is a coast form of *E. melliodora*, but, as botanists know, the species is quite distinct. Generally where *E. Bosistoana* is called Yellow Box the name is suggested by the colour of the wood.

Between the Bogan and the Lachlan viâ Nymagee the total of the Eucalypts noted was—*E. populifolia*, *E. largiflorens*, *E. sideroxylon*, *E. Woollsiana*, *E. intertexta*, *E. melliodora*, *E. rostrata*, *E tereticornis* var. *dealbata*, *E. Morrisii*, *E. oleosa*, *E. dumosa*, *E viridis*, *E. uncinata*, a Mallee not identified, and one tree of Ironbark Box.

The Acacias were represented by *A. pendula*, *A. homalophylla*, *A. excelsa*, *A. aneura*, *A. doratoxylon*, *A. Oswaldi*, *A. hakeoides*, *A. decora*, *A. dealbata* (green variety), *A. Burkittii*, *A. calamifolia*, *A. triptera*, *A. amblygona*, *A. salicina*, *A. stenophylla*, *A. colletioides*, *A. rigens* (?), *A. undulifolia* (?), and *A.* sp.

EXPLANATION OF PLATE.

Fig. 1.—*Pittosporum phillyræoides*, DC. (Berrigan), Nymagee, N.S.W.

Fig. 2.—*Eremophila longifolia*, F.v.M. (Emu Bush), Bourke, N.S.W.

NOTES AND EXHIBITS.

Mr. D. G. Stead exhibited a beautiful preparation of coral polyps collected at Shark Island, Port Jackson. Also some aboriginal relics which he had discovered in December last, buried in a cave at the top of a midden on the shores of Port Hacking.

Dr. C. MacLaurin exhibited a specimen of a "vegetable caterpillar" *(Cordyceps)* from New Zealand.

Mr. A. A. Hamilton exhibited botanical specimens of interest for the identification of which he was indebted to J. H. Maiden, Esq., F.L.S., as follows :—

Bæckea camphorata, R.Rr.—Blackheath (A. A. Hamilton, October, 1900). Described in the Flora Australiensis as having fifteen stamens or more. The specimens exhibited were collected from Medlow to Mt. Victoria, and have only five stamens.

Erechtites Atkinsoniæ, F.v.M.—Bulli Pass (A. A. Hamilton, February, 1900). The localities previously recorded are Grose River (R.Br.) and Blue Mountains (Miss Atkinson) [Flora Australiensis]; and Blue Mountains to Queensland [Handbook of the Flora of N.S.W.]. This exhibit establishes a southerly locality.

Pultenæa mucronata, F.v.M.—Blackheath (A. A. Hamilton, October, 1900). Localities previously recorded, Victoria and South Australia [Flora Australiensis]; Southern Dividing Range [Handbook of the Flora of N.S.W.]. Specimens of this plant in the Sydney Herbarium are from Kiandra, and Mr. Forsyth has recently collected it near Tumberumba.

Caladenia filamentosa, R.Br.—Manly (E. Cheel & A. A. Hamilton). Localities previously recorded, Mudgee (Woolls) [Flora Australiensis]; west of Dividing Range, from Warrah to Boorowa [Handbook of the Flora of N.S.W.].

Mr. Froggatt exhibited specimens of *Idolothrips spectrum*, Newm., the largest known Thrips. The insects are plentiful at the present time among dead leaves, and can be obtained by shaking dead bushes over a net.

Mr. R. H. Cambage exhibited a series of photographs, timbers, and herbarium specimens in illustration of his paper.

Professor Tate contributed the following Note on the nomenclature of a Port Jackson mollusc. The Port Jackson *Cingulina Brazieri*, Angas, has long resisted recognition, as it has generally been assumed to be, or related to, *C. spina*, Crosse (*Turritella*), in the Family *Pyramidellidæ*. Mr. Hedley has now discovered specimens which apply to the figure and diagnosis of the type, but the generic position is to *Terebra;* and because Angas's species-name is already in use in that genus, I apply in its place the name of Mr. Hedley in recognition of his persistent effort for a more correct classificatory position of the species. *Terebra Hedleyi*, Tate, is remarkable for its glassy pellucidity and its encircling ribs.

Mr. S. J. Johnston exhibited a collection of lizards procured by Mr. A. E. Finckh of the Sydney University, on Lizard Island, during his visit to the Barrier Reef in the early part of this year. It comprised four species, represented by about thirty-five specimens, namely, *Lygosoma pardalis*, Macl., *L. peronii*, D. & B., *L. pectorale*, De Vis, and *Gehyra variegata*, D. & B. Captain Cook and Sir Joseph Banks landed on the island in August, 1770. They found that on the north-west side it "abounded with lizards of a very large size, some of which we took. . . . . . As we saw no animals upon this place but lizards, I called it Lizard Island" (Hawkesworth, Vol. iii. pp. 194-195). Whether the specimens then collected were ever described or recorded does not appear to be ascertainable. The four species now recorded are all represented by animals of small size.

The Rev. Walter W. Watts communicated the following

Note on Some Richmond River Hepatics.

In response to a request made to me in May, 1900, I sent about 60 specimens of Hepatics, collected on the Richmond River, to Dr. E. Levier, of Florence. In December Dr. Levier reported upon these, supplying the determinations of Dr. Stephani, the distinguished specialist in this interesting family of Cryptogamic plants. As comparatively little work seems to have been done with the Hepatics of New South Wales, I beg, for purposes of record, to submit the following list of species to the Society. It includes two new species (marked with an asterisk).

Acrolejeunea securifolia, (Nees) Steph.
A. Wildii, Steph.
Brachiolejeunea plagiochiloides, Steph.
Cheilolejeunea muscicola, Steph.
**C. Richmondiana*, Steph.
Dendroceros Muelleri, Steph.
Frullania cinnamomea, Carr. & Pears.
F. falciloba, Mitt.
F. fugax, Mitt.
F. Hampeana, Ldnbg.
F. hypnoleuca, Tayl.
F. pycnantha, Tayl.
F. spinifera, Mitt.
F. squarrosula, Mitt.
Lejeunea (Eulejeunea) tumida, Mitt.
Lepidozia capillaris, Ldnbg.
Lophocolea heterophylloides, Nees.
Madotheca Stangeri, Gottsche.
Marsupidium setulosum, Mitt.
Mastigobryum Mittenii, Steph.
**Metzgeria Wattsiana*, Steph.
Plagiochasma australe, Tayl.

A second letter from Dr. Levier conveyed some notes on two specimens which Dr. Stephani had reserved for closer examination. They proved to be species which, in Dr. Levier's words, constituted "veritable curiosities in hepaticology." One of them was *Lepidozia longiscypha*, Tayl., a species which no one in Australia had found for nearly 50 years, and which had, so Dr. Stephani said, become "a myth." It was found by me in Shaw's Bay, at the mouth of the Richmond, mixed with a new *Sphagnum*. The other species was *Lepidozia seriatitexta*, Steph. This species had been found, not long since, by Peter Dusèu in the south of South America, and had been determined as a new species by Dr. Stephani, whose description of it was only published in the course of 1900. My specimen was found in the Alstonville Cutting, about five miles from Ballina. The species is thus another link of connection between Australia and Patagonia.

WEDNESDAY, JUNE 26TH, 1901.

The Ordinary Monthly Meeting of the Society was held in the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, June 26th, 1901.

Mr. J. H. Maiden, F.L.S., &c., President, in the Chair.

Messrs. **John B. Cleland**, M.B., Ch.M., Prince Alfred Hospital; **William B. Gurney**, Department of Agriculture, Sydney; and **Richard Helms**, Department of Agriculture, Sydney, were elected Members of the Society.

The President announced that the Council had elected Mr. J. P. Hill, B.Sc., F.L.S., a Member of the Council, *vice* Mr. Cecil W. Darley, who had resigned on account of his departure for England.

DONATIONS.

Department of Agriculture, Brisbane—Queensland Agricultural Journal. Vol. viii. Part 6 (June, 1901). *From the Hon. the Secretary for Agriculture.*

Australian Museum, Sydney—Special Catalogue. No. i. (Nests and Eggs of Birds found breeding in Australia and Tasmania. By A. J. North, C.M.Z.S.). Part i. (June, 1901). *From the Trustees.*

Department of Mines and Agriculture, Sydney—Agricultural Gazette of New South Wales. Vol. xi. T.p., index, &c.; Vol. xii. Part 6 (June, 1901). *From the Hon. the Minister for Mines and Agriculture.*

Royal Society of New South Wales, Sydney—Abstract of Proceedings, May 1st and June 5th, 1901. *From the Society.*

The Surveyor, Sydney. Vol. xiv. No. 4 (May, 1901). *From the Editor.*

Three Entomological Separates from the Agricultural Gazette of N.S.W., being Miscellaneous Publications, Nos. 447, 465, 468 (1901). By W. W. Froggatt, F.L.S. *From the Author.*

Australasian Journal of Pharmacy, Melbourne. Vol. xvi. No. 186 (June, 1901). *From the Editor.*

Field Naturalists' Club of Victoria—Victorian Naturalist. Vol. xviii. No. 2 (June, 1901). *From the Club.*

Department of Mines, Hobart—Progress of the Mineral Industry of Tasmania for the Quarter ending 31st March, 1901: Government Geologist's Report on the Tin-Bearing Capabilities of the Gladstone District (May, 1901). *From the Secretary for Mines.*

Department of Agriculture, Perth, W.A.—Journal. Vol. iii. Parts 5-6 (May-June, 1901). *From the Secretary.*

American Geographical Society, New York—Bulletin. Vol. xxxiii. No. 2 (1901). *From the Society.*

American Naturalist, Cambridge. Vol. xxxv. No. 413 (May, 1901). *From the Editor.*

Washington Academy of Sciences — Proceedings. Vol. iii. pp. 157-216, pls. xiv.-xxvi. (May, 1900). *From the Academy.*

Johns Hopkins University, Baltimore—One Separate from the University Circulars, No. 151 (1901) (The Oyster Reefs of N. Carolina. By C. Grave, Ph.D.) *From the University.*

Ohio Agricultural Experiment Station, Wooster.—Special Bulletin No. 4 (April, 1900): Bulletin No. 121 (September, 1900). By A. D. Selby. *From the Author.*

Public Museum of the City of Milwaukee—Eighteenth Annual Report of the Board of Trustees (1899-1900). *From the Trustees.*

Zoological Society of Philadelphia—Twenty-ninth Annual Report of the Board of Directors (April, 1901). *From the Society.*

Museo Nacional de Buenos Aires—Comunicaciones. Tomo i. No. 8 (Marzo, 1901). *From the Museum.*

Société Scientifique du Chili, Santiago—Actes. Tome x. 3^me^-5^me^ Livraisons (Novembre-Decembre, 1900). *From the Society.*

Conchological Society of Great Britain and Ireland, Manchester—Journal of Conchology. Vol. x. No. 2 (April, 1901). *From the Society.*

Entomological Society of London—Transactions, 1901. Part 1. *From the Society.*

Geological Society, London—Quarterly Journal. Vol. lvii. Part 2 (No. 226; May, 1901). *From the Society.*

Linnean Society of London—Journal. *Botany.* Vol. xxxv. No. 242 (April, 1901); *Zoology.* Vol. xxviii. No. 181 (April, 1901): List of Members, 1900-1901. *From the Society.*

Royal Society of London—Proceedings. Vol. lxviii. No. 444 (May, 1901). *From the Society.*

Zoological Society of London—Abstract of Proceedings, May 7th, 1901. *From the Society.*

Archiv für Naturgeschichte, Berlin. lxvii. Jahrgang. (1901) Beiheft. *From the Editor.*

Medicinisch-naturwissenschaftliche Gesellschaft zu Jena—Jenaische Zeitschrift. xxxv. Band. Heft iv. (1901). *From the Society.*

Naturwissenschaftlicher Verein zu Bremen—Abhandlungen. Band xv. Heft 3 (1901). *From the Society.*

Zoologischer Anzeiger, Leipzig. xxiv. Band. Nos. 642-643, (April-May, 1901). *From the Editor.*

Kongliga Svenska Vetenskaps-Academie, Stockholm—Ofversigt. 57 Argangen (1900). *From the Society.*

Museo Civico di Storia Naturale di Genova—Annali. Serie 2ª. Vol. xx. (1899-1901): Indice Generale Sistematico delle due Prime Serié (Vol. i., 1870, a xl., 1901). *From the Museum.*

Asiatic Society of Bengal, Calcutta—Journal. Vol. lxix.—1900—Part i., No. 2; Part ii., Nos. 2-4; Vol. lxx.—1901—Part iii., No. 1: Proceedings, 1900, Nos. ix.-xi. and Extra No. xii. (October-December); 1901, Nos. i.-ii. (January-February). *From the Society.*

Indian Museum, Calcutta—Notes from the, &c. Vol. iii. Nos. 6-7 (1896); Vol. iv. Nos. 1-6 (1896, 1899-1900); Vol. v. Nos. 1-2 (1900). *From the Museum.*

College of Science, Imperial University of Tōkyō—Journal. Vol. xv. Part 1 (1901). *From the University.*

Societas Zoologica Tokyonensis—Annotationes Zoologicæ Japonenses. Vol. iii. Partes ii.-iv. (April, 1901). *From the Society.*

THE "SHOT-HOLE" FUNGI OF STONE-FRUIT TREES IN AUSTRALIA.

By D. McAlpine.

(Communicated by J. H. Maiden, F.L.S., &c.)

There are a number of fungi, growing principally upon leaves, which attack the tissues in spots and cause these spots to dry up and wither, until finally they drop out and leave more or less round holes in the leaf as if it were riddled by shot. The spores of such fungi evidently start from a definite centre and produce hyphæ radiating all round till they have exhausted or destroyed the tissues within a certain radius, and the dried-up spots thus deprived of their substance soon lose organic connection with the surrounding tissues. The diseased tissue shrinks and gradually becomes detached, so that in many cases the line of demarcation between the sound and diseased portions is so sharply marked as to make a complete raised ring round the spot. A healing process takes place by the formation of a kind of callus which prevents the further disruption of the leaf. Fresh spores are being constantly produced by the fungus and conveyed to new centres of infection, so that the leaf soon becomes riddled with holes.

From the fungus point of view, the object of the falling away of circumscribed portions of the leaf is obvious. They form a convenient substratum for the production and wintering of the spores, until favourable conditions arise for their further development. But that the formation of the callus in the leaves of stone-fruit trees is an effort of the tree to get rid of the parasite is evident from the behaviour of such leaves when plucked from the tree and kept moist for several days. The mycelium of the fungus soon begins to spread from the spots to the other portions of the leaf, producing large indefinite patches which bear innumerable fructifications of the fungus. Here there is no formation of callus, and this following upon the stoppage of the vital activities of the leaf, leads to the conclusion that the callus-formation or separation layer is a special character possessed in particular by the living leaves of the stone-fruit trees and designed to minimise or localise the attacks of the fungus.

The bearing of this on the treatment of the disease is obvious. It has been recommended to give the first spraying to Apricot trees badly affected with shot-hole as soon as the leaves turn colour, because when they fall they deposit the spores in the soil. But before this happens innumerable minute round portions of the leaves have already fallen to the ground, bearing with them the seeds of the disease, which will be ready to germinate at least when the buds burst.

FUNGI PRODUCING "SHOT-HOLE" GENERALLY.

Quite a number of fungi act in this way, at first producing sharply defined blotches, usually circular in outline, brown in colour and surrounded by a red margin, then finally causing perforations in the leaf. Bacteria are often found on the "shot-hole" spots, without any other fungus being present, and they are probably active agents in their production.

There are at least twenty species of fungi at present known to produce or to be associated with "shot-hole" effects in the leaves of *Prunus*, and two of these are new species determined for Victoria. The following attack the various cultivated plants as well as other species of *Prunus* :—

* 1. *Ascochyta chlorospora*, Sacc.—V.
2. *Cercospora cerasella*, Sacc.
* 3. *C. circumscissa*, Sacc.—Q.
4. *C. prunicola*, E. & E.
5. *Cladosporium carpophilum*, Thuem.—N.S.W.
* 6. *Clasterosporium amygdalearum*, Sacc.—V., S.A., N.Z.
7. *Cylindrosporium padi*, Karst. (= *Septoria cerasina*, Peck).
* 8. *Exobasidium vitis*, Prill. & Del.—V., Q.

* 9. *Gnomonia circumscissa*, McAlp.—V.
10. *Ovularia circumscissa*, Sorok.
11. *Phyllosticta circumscissa*, Cooke.
*12. *P. perforans*, Sacc. & Matt.—V.
*13. *P. persicæ*, Sacc.—V., S.A.
*14. *P. prunicola*, Sacc.—V., S.A., Q.
15. *P. serotina*, Cooke.
*16. *Puccinia pruni*, Pers.—V., N.S.W., Q., S.A., T.
*17. *Septoria amygdali*, McAlp.—V.
18. *S. effusa*, Desm.
19. *S. pruni*, Ellis.
20. *S. ravenelii*, Thuem.

Cladosporium carpophilum is usually associated with scabbing of Peaches and Plums, but in Ohio it also causes "shot-hole" in leaves of the Peach.† *Phyllosticta perforans*‡ produces circular or elliptic perforations, and *Ovularia circumscissa*§ is noted by Sorokin as producing "shot-hole" just as bad as *Cercospora circumscissa*.

FUNGI PRODUCING "SHOT-HOLE" IN AUSTRALIA.

Since the shot-hole appearance of the leaves of stone-fruit trees has become very common of late years, I investigated the subject at some length and examined over a thousand specimens in connection with it. The results were very remarkable, and not only were several fungi new to science discovered, but the relationships of some of the fungi already known were cleared up.

It does not necessarily follow that because a fungus is found associated with the "shot-hole" it therefore produces the disease. This can only be definitely settled by infection experiments, but in the absence of such, there are a number of fungi so constantly associated with the effects that in all probability they produce them. Of the shot-hole fungi given above, the ten marked with an asterisk are found in Australia, although some of them are not very common. *Cladosporium carpophilum*, which causes "freckle" in the Peach, is not known to produce "shot-hole" here as in Ohio. *Cercospora circumscissa* is only recorded on the Peach from Queensland by Massee, and *Septoria amygdali* was only found in one locality associated with "shot-hole" in Almond-leaves. *Puccinia pruni* has only been known very occasionally to produce shot-hole effects, and there remain six species of fungi which may be regarded as principally producing the disease in Australia, viz.:—

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† Selby, Bull. No. 92, Ohio Ag. Exp. Station, p. 231 (1898).

‡ Sacc., Syll. xiv., p. 849 (1900).

§ Sacc. Syll. xi. p. 598 (1895).

Clasterosporium amygdalearum.
Phyllosticta prunicola.
Ascochyta chlorospora.
Gnomonia circumscissa.
Exobasidium vitis.
Phyllosticta persicæ (including *P. circumscissa*).

Clasterosporium amygdalearum is essentially the shot-hole fungus of Australia, and is well fitted to survive and spread by reason of its mode of life and the different stages in its life-history which enable it to adapt itself to the various climatic conditions prevailing. It has been found in such widely separated localities as Victoria, South Australia, and New Zealand, and on Almond and Apricot, Peach and Plum trees.

It has been recorded as far back as 1883 for South Australia, and not only occurs on the leaves, but likewise on the branches and fruit of stone-fruit trees. During the growing season it produces abundant tufts of conidia, and they readily germinate if the necessary moisture is present. It can live, grow and multiply either upon fresh or dead tissue, and thus it can produce its conidia either on living portions of the tree or on dead parts separated from it.

In addition to this, it can develop a pycnidial stage in which the reproductive bodies are enclosed in a case and fitted to survive the winter.

Phyllosticta prunicola is found associated with and growing stage of it. It may either succeed or accompany the latter, and occurs on all the cultivated species of *Prunus*, although *C. amygdalearum* has not as yet been found on the Cherry here. The pustules are not usually found on the leaves still borne by the tree, as the brown spots fall away and then develop the perithecia, but during wet autumns they are not at all uncommon on attached leaves. On the shrivelled rotten fruits lying on the ground the perithecia sometimes literally cover the surface.

Saccardo* suggests that the highest or ascidial stage of this fungus is *Leptosphaeria pomona*, Sacc., but I have only found *L. vagabunda*, Sacc., on dead Peach branches.

The life-history as far as definitely known at present would be represented thus:—

1. Conidial stage *(Clasterosporium)*.
2. Pycnidial stage *(Phyllosticta)*.

These stages are usually accompanied by various other fungi which act as scavengers and hasten decay.

While neither of these two stages has been found north of the Dividing Range in Victoria, their place seems to be taken by two other related fungi which produce shot-hole effects, viz., *Ascochyta chlorospora* and *Gnomonia circumscissa*.

Ascochyta chlorospora was first found on languid leaves of the Plum in Italy, but has since been met with in Victoria and South Australia, causing "shot-hole" of the Almond, Apricot, Peach and Plum. It also occurs on the withered fruit of Peach and Apricot, and although found in the neighbourhood of Melbourne, it seems more particularly adapted for the Goulburn Valley and the dry northern regions.

Gnomonia circumscissa was often found associated with the preceding, and I regard it as the ascidial stage of that fungus. It occurred on the leaves of the various cultivated species of *Prunus*, scattered promiscuously over the leaf when dead, but on definite rounded spots on the living leaf, from which the tissue ultimately dropped out. I have not met with any pycnidial stage of this fungus, and the life-history stages at present known are as follows:—

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* Syll. Fung. ii. p. 5 (1884).

1. Conidial stage (*Ascochyta*).
2. Ascidial or highest stage (*Gnomonia*).

In an allied species found on Cherry-leaves (*G. erythrostoma*) the pycnidial stage is referred to a species of *Septoria*.

Exobasidium vitis.—While investigating the cause of shot-hole in Apricot leaves from a dry district such as Ardmona during the month of October, it was found to be quite different from that in the neighbourhood of Melbourne. In my own garden at that season of the year there was abundance of *Clasterosporium amygdalearum* producing "shot-hole" in Apricot leaves, but that fungus has never been found in the Ardmona district. Instead of that, white patches occur on the brown spots of the leaves, and on microscopic examination these turned out to be the same as those previously found on the Vine in the same district and consisted of *Exobasidium vitis.*

This fungus has already been described for Australia in my "Additions to the Fungi on the Vine," and the disease caused by it was first observed there in February, 1895. In the interval this fungus has evidently spread from the Vine to the leaves of the Apricot, Peach and Plum, but while in the Vine leaves it causes patches to become red or brown, in the leaves of stone-fruit trees it produces actual "shot-hole."

The occurrence of this fungus in association with the shot-hole of stone-fruit trees is interesting in many ways, and adds another to the numerous fungi producing such effects.

It has been pointed out by various writers that there is some peculiarity about the leaves of stone-fruit trees which renders them liable to be affected in this way, and the present case shows that different leaves are affected by the same fungus in different ways.

Phyllosticta persicæ (including *P. circumscissa*).—In any list of "shot-hole" fungi for Australia it may seem rather strange that *Phyllosticta circumscissa* is not mentioned, which is regarded by many as the "shot-hole" fungus *par excellence*, as if it were the only fungus capable of producing such effects, and whenever a shot-hole is met with in the leaves of stone-fruit trees it is usually attributed without any investigation to *P. circumscissa*. And yet, although I have spent over ten years in investigating the diseases of plants in Australia and examined over a thousand leaves of stone-fruit trees from various parts of Australia and New Zealand, submitting them to the most searching examination, wherever a "shot-hole" was due to a *Phyllosticta*, I have invariably found it to be *P. prunicola*, or very occasionally *P. persicæ*. *P. circumscissa* was determined by Cooke in 1883 from leaves of Apricot and Cherry sent from South Australia by the late Frazer S. Crawford, and the following brief description was given of it in *Grevillea* (Vol. xi., p. 150, June, 1883):—"On both surfaces. Spots orbicular, rufous-brown, at length falling out and leaving round holes. Perithecia few, minute, innate. Sporules elliptic. 8 × 2 μ."

Both *P. prunicola* and *P. persicæ* have been met with on Apricot-leaves from South Australia, and *P. circumscissa* approaches so closely to the latter constituted by Saccardo in 1879 from Peach-leaves, and the spores are sometimes so similar that it is highly probable they both represent the same fungus on different host-plants, and so I have included the shot-hole fungus of Cooke under the previously determined one of Saccardo. It is presumed that the spores were hyaline, and hence I have referred it rather to *P. persicæ* than to *P. prunicola*, in which the spores are clear olive.

P. persicæ has been found both in Victoria and South Australia on Apricot and Plum-leaves as well as on Peach-leaves. It is of comparatively rare occurrence, and does not seem at present of great economic importance.

Puccinia pruni.—This fungus has not hitherto been associated with "shot-hole," and since this is the first record of it, the subject may be briefly referred to. Some Almond-leaves sent from South Australia were badly riddled with "shot-hole," and also severely affected with *Puccinia pruni*. After careful examination, it was found that the rust-fungus was responsible for the effects, although it had not been previously known to act in that way.

This fungus has become so well established in Australia, owing to the climatic conditions being peculiarly favourable to its development and spread, and its effects have become so intensified season after season, that now instead of merely causing the tissue of a leaf to become yellow in spots, it causes these spots to drop out, and the tree protects itself by limiting the area of operations as much as possible. The cumulative effects of fungi year after year may lead to startling results, and in the case of this particular rust, not only does it occur on the leaves of stone-fruit trees as in the older countries of the world and occasionally on the upper surface, but also on the branches and fruit, causing considerable damage to the latter. So the extension in spread is often accompanied by an intensity of action which is more destructive to the tissues than formerly.

DISTRIBUTION OF THE "SHOT-HOLE" FUNGI IN AUSTRALIA.

I have only had an opportunity of examining specimens from certain parts of the Commonwealth, and therefore only a limited view can be taken of the distribution, but there are sufficient data to show that the nature of the climate is the great determining factor in the distribution of the species.

Around Melbourne and south of the Dividing Range in Victoria I found the prevalent forms to be *C. amygdalearum* and *P. prunicola*; but in the Goulburn Valley and the drier districts of Victoria it was *A. chlorospora* and *G. circumscissa*, together with *Exobasidium vitis*.

In South Australia, *C. amygdalearum* and *P. prunicola* were the common forms, with *P. persicæ* occasionally.

In Queensland, in the neighbourhood of Brisbane, *Cercospora circumscissa* was determined by Massee on Peach-leaves, and this is the only State in which it has been recorded. This is the great "shot-hole" fungus of California, especially in the coast regions, on account of the frequent fogs and the general humidity of the atmosphere. *P. prunicola* and *E. vitis* also occurred in Queensland.

It is interesting to notice that *C. amygdalearum* was found in the Auckland district of New Zealand as well as in Victoria and South Australia, but *P. prunicola* has not been recorded yet, although it probably occurs there.

I am not aware of any of these "shot-hole" fungi having been definitely determined for New South Wales, although some of them are almost sure to occur there. Dr. Cobb has indeed referred to the "Shot-hole disease of the Apricot and other Stone-fruit trees" as being due to *P. circumscissa*,[*] but the drawing given there in illustration of his remarks only shows a Hyphomycete and probably a form of *Torula* which has nothing to do with the production of the disease.

SHOT-HOLE EFFECTS IN RELATION TO THE HOST-PLANT.

It is a question for consideration whether such effects are due to the nature of the fungus or the nature of the host-plant, and the prevalence of shot-hole effects in the genus *Prunus* would seem to indicate that the reaction of the host-plant has a considerable influence on the result.

Tubeuf in his "Diseases of Plants induced by Cryptogamic Parasites," devotes a chapter to the reaction of host to parasitic attack, and concludes that while the reaction is fairly constant for the same host and fungus, yet different hosts behave differently in attacks of the same fungus. In the case of many leaf-spot diseases, he assumes that the mycelium excretes a ferment which causes the immediate death of any cell it may touch. The death of the cells would soon prevent the further extension of the parasitic fungus, and in this way the area of the disease would be circumscribed. Duggar in his paper on "The shot-hole effect on the foliage of the genus *Prunus*,"[†] states his belief that from the number of species of fungi producing this effect, it was not due to any peculiarity on the part of the fungi, but to a peculiar reaction of the plant to the injuries received. Spraying experiments with chemicals such as formalin and corrosive sublimate showed that similar results followed from their use, and from these experiments and other observations the author arrived at the conclusion "that the shot-hole effect of plums, peaches, cherries, &c., is a peculiar reaction of the plant to injuries such as may be produced by many fungi, by certain chemical reagents and possibly by other causes."

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[*] Agr. Gaz. N.S.W. Vol. iii. p. 290 (1892).

[†] Proc. Soc. Prom. Agr. Sci. pp. 64-69 (1898).

It has already been shown that at least twenty different species of fungi produce shot-hole effects, and this result seems to be due to an effort on the part of the plant to throw off the irritant, whatever it may be. It is not to be inferred, however, that the spotting of the leaves can develop into "shot-hole" only in the genus *Prunus*, although it is so very marked there. I have observed the cumulative effects of a fungus (*Phyllosticta pelargonii*, n. sp.) for some years on an Ivy-leaved Pelargonium. For several years the leaves had been spotting badly, and this season actual shot-hole was produced just as bad as in the Plum or Peach-leaves.

APPLE AND APRICOT "SHOT-HOLE" CONTRASTED.

The great Australian shot-hole fungus, *Phyllosticta prunicola*, attacks the Apple as well as the stone-fruit trees, and it is interesting to note the different ways in which the fungus affects the Apricot and the Apple-leaf, for instance. In the Apricot-leaf there are generally produced, as the final effects of the fungus, distinct round holes, as if small shot from a gun had passed through, and the margin of the hole is neatly and firmly rounded off by the callus or healing tissues. The wound is thus healed, the cause of the mischief is thrown off, and the injury is restricted as much as possible. In the Apple-leaf, on the other hand, there are minute round or irregular brownish spots produced, generally surrounded by the ruddy-brown margin, as in Apricot, but large surrounding portions are discoloured besides, The spot gradually becomes thinner and thinner, as if excavated from above and below, until finally an irregular rupture takes place, and the frayed margin of decayed tissue usually remains, without any attempt at a healing process. It is on the marginal decayed tissue that the perithecia are generally produced, and soon this falls away in shreds and patches, carrying the perithecia with it. The process of healing seems to have been developed in the tissue of the leaves of stone-fruit trees, because they are so peculiarly susceptible to the fungus. While the leaves of the Apricot-tree are riddled as if with shot, the Apple-leaf is not generally much affected, and the disease is not considered serious, nor generally observed by the orchardist. There may be some peculiar delicacy and susceptibility about the genus *Prunus*, especially when grown under Australian conditions, which causes it to respond readily to any injury, independent of the particular species of fungus concerned in it. In the Apricot this particular fungus causes "brown spot" of the branches, "shot-hole" of the leaf, and "scab" of the fruit, while it is only as yet known on the leaf of the Apple, causing leaves here and there to be ruptured in spots, or large brown patches to be formed towards the centre. There is an Apple-tree growing in my garden beside an Apricot-tree, and while it is difficult to find a leaf unaffected in the latter, it requires careful searching to detect a single leaf of the Apple with the fungus upon it.

SUMMARY.

There are at least 20 known species of fungi associated with the shot-hole of stone-fruit trees belonging to the Sphaeropsides and Hymenomycetes, with the exception of one (*Gnomonia circumscissa*), which belongs to the Pyrenomycetes, and is the higher stage of one of the imperfect fungi (*Ascochyta chlorospora*). There are at least 10 species associated with "shot-hole" in Australia, the chief of these being, as far as Victoria is concerned, *Phyllosticta prunicola* with its conidial stage *Clasterosporium amygdalearum*; and *Gnomonia circumscissa* with its conidial stage *Ascochyta chlorospora*.

The shot-hole effects in stone-fruit trees are variously explained. Tubeuf considers that the mycelium of the fungi concerned excretes a ferment or poison, causing the death of any cell it may reach, and consequently the effects are so deadly and so circumscribed that the well-known appearance is produced. Duggar, on the other hand, is of opinion that it is not due to any peculiarity on the part of the fungi, but to some inherent property of the plant itself, whereby it has this peculiar reaction to injuries received. He called attention to the fact that nearly all injuries of stone-fruit trees take the form of shot-hole effects, but the fungi concerned in these effects were only studied to a slight extent.

My own observations generally agree with the latter, and show that the healing tissue is only formed round the spot while the leaf is alive, and that it is a protective check against injuries produced by fungi and other agents.

While *Phyllosticta prunicola* and *P. persicæ* have been found on the "shot-hole" of Apricot-leaves from South Australia, no species agreeing with *P. circumscissa* of Cooke has been determined. It might either be an immature form, or very probably *P. persicæ* determined by Saccardo in 1879 on Peach-leaves.

ON THE "ONVAR" OF MALEKULA, NEW HEBRIDES.

BY WALTER R. HARPER.

That the use of the bow, just as the potter's art, should never have spread into Polynesia is strange, but not more so than the fact that in many islands of the Western Pacific it is unknown or else is merely a toy for children.

For instance, a bow 6 feet in height and strung with a strip of rattan is a formidable offensive weapon in the Papuan Gulf, up the Fly River, and in North-eastern New Guinea, yet the natives of vast areas of that island (as in the south-east) are unacquainted with it. In the Bismarck Archipelago it is used as a toy on New Britain,[*] and on New Ireland not at all.[†] In the Solomon Group, although known in all the southern islands, it has given place to long, heavy thrusting spears, and, in places, slings,[‡] except on Malanata, where it is still used in war. On Guadalcanar, a small bow "with arrows made from the midrib of the sago-palm is used solely for shooting birds or fish."[§] In the Santa Cruz Group it is an implement of warfare, and in the Banks Islands is the principal weapon, spears being practically unknown there.[||] Where it has not been displaced by firearms, it is common through the New Hebrides, together with spears and slings. It is known in the Loyalty Group,[¶] but is not found on the great neighbouring island of New Caledonia. In the Fijis, the limit of its distribution to the east, it is little more than a toy. When one remembers that over a great part of the area traversed above defensive armour of any kind is unknown, the neglect of such a serviceable weapon as the bow is rather surprising.

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[*] Rev. B. Danks, Report Aust. Assoc. Adv. Science, Vol. iv.

[†] Ratzel, "History of Mankind," Vol. i., p. 234.

[‡] Codrington, "The Melanesians," p. 305.

[§] C. M. Woodford, "A Naturalist among the Head-Hunters," p. 30.

[||] Codrington, *op. cit.*, p. 360.

[¶] Ratzel, *op. cit.*, p. 234.

Whatever may have been the process of evolution of the bow, it is probable that the necessity for some protection for the hand from the recoiling bowstring became early evident. Schliemann* in his excavation of the fourth city on the site of Troy, discovered a flat oblong-shaped object made from bone and pierced with three holes. Sir John Evans identified it "as a guard or bracer used by archers to prevent the wrist being hurt by the bowstring. . . . The guards or bracers found in England are of stone and have three perforations at each end." This identification would have been difficult had we not an example of almost exactly similar guards in use by the present Eskimo "composed of several pieces of bone tied together and fastened on the wrist by a bone button and loops."† Occasionally the guard is part of the bow, as with the Monbutto. Schweinfurth says,‡ "These bows are provided with a small hollow piece of wood for protecting the thumb from the rebound of the string." Mason§ compares this with the guard used by the Tinneh Indians, "which is a bit of wood the shape of a bridge on a violin attached to the bow and not to the shooter's wrist." Other of the American tribes use a band of leather round the left wrist,‖ sometimes ornamented with pieces of inlaid silver. In Europe the Mediterranean form of arrow release¶ was used in the Middle Ages and is used now by modern archers. "A leather glove or leather finger strings are worn, as Roger Ascham expresses it, "to save a man's fingers from hurtinge."

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* "Ilios," p. 566.

† Wood, "Natural History of Man," Vol. ii., p. 710.

‡ "The Heart of Africa," Vol. ii., p. 111.

§ "The Origin of Invention," p. 386, and Smithsonian Report, 1893, p. 677.

‖ Bancroft, "Native Races of America," Vol. i., pp. 494 and 578.

¶ See a résumé of Professor Morse's interesting paper on "Methods of Arrow Release" in "Nature," Vol. 35, pp. 13 and 14.

In Asia the Mongolian release is common. "The thumb is protected by a guard; the Manchus, Chinese and others use a thick ring worn near the base of the thumb. It may be made of any hard material, such as horn, bone, ivory, quartz, agate, or jade."

The Japanese archer uses a glove consisting of the thumb and two fingers,* or a guard on the outer side of the forearm.† In the Western Pacific‡ by far the most elaborate guards are found in New Guinea. They are made of wickerwork or finely plaited grass, and stretch from the wrist to the elbow. A decorative effect is obtained by weaving or plaiting; sometimes plumes of cassowary feathers are fastened to the upper end. Frequently bands of bark are substituted, ornamented by incised patterns.

These New Guinea guards may be called arm-guards,§ to distinguish them from those of the New Hebrides, which are really thumb-guards. What seems to me a feasible explanation of the difference between the two is that the stiff rattan string of the New Guinea bow does not recoil as far as the fibre cord of the New Hebridean bow, and consequently the smack would be felt on the fore-arm and not on the hand. Besides, the bows are lighter in the south and the string lies more closely to the wood.

In the Solomon Group and in islands further to the south, the guard is made from a strong creeper. A length of the plant is taken, split into two, the ends pared down and a spiral wrist band formed.

Intermediate between these two (British N.G. and Solomons) is the arm-guard of German New Guinea. Like that of the Solomons, it consists of a spiral bandage made from a creeper, and like that of the Fly River it extends from the wrist almost to the elbow.

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* "Nature," *l.c.*, p. 14.

† Mason, Smithsonian Report, 1893, pp. 635-637.

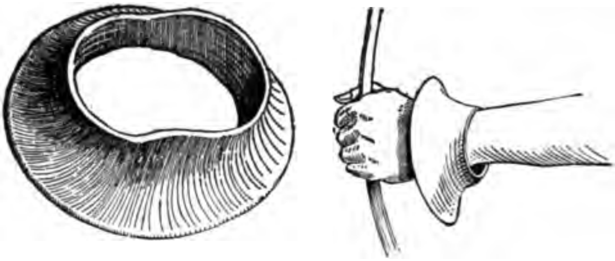
‡ For drawings of several guards from this area see Edge-Partington's Ethnographical Album, 1st Series, Plate 140, figs. 2 and 3; 2nd Series, Plate 76, fig. 9; 3rd Series, Plate 87, figs. 1 to 5.

§ Not *armlets*. This word, so frequently used in the above sense by writers on New Guinea, &c., should be confined to the rings or bands which are worn as decorations round the upper part of the arm. Any other use of the term is very confusing.

The guard used on Efate, New Hebrides, is very simple. It consists merely of a plain ring cut from a hard wood and rounded on the outside.

The "onvar" or thumb-guard of Malekula, though itself simple enough, is a slight improvement on this form. It was first mentioned by Cook* and described by Forster† in his account of the voyage. "On the left wrist they wore a circular wooden plate neatly covered and joined with straw about five inches in diameter, upon which they broke the violence of the recoiling bowstring and prevented it from hurting their arms."

Forster here describes one of the highest class "onvars." Sometimes they are in two pieces and are fastened by long lengths of the thin inner bark of a vine neatly worked over all round. Again, they are frequently in one piece over the outside surface of which the bark is plaited. It is probable that these decorated guards are insignia of chiefs, as are occasionally the spiral bands in the Solomon Group.‡ However, the general form is a circular piece of hard though light wood about 3 c.m. in thickness, 12 c.m. outside diameter at the base, bevelled off to an outside diameter of 7 c.m. at the top and pierced by a hole large enough to admit the hand of the wearer. The average diameter



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* Cook's "Voyages," Vol. v., p. 35.

† G. Forster, "Voyage round the World," Vol. ii., p. 215.

‡ Ratzel, *l.c.*, p. 227.

of this opening in five specimens given me by the Rev. T. Watt Leggatt, of Malekula, is 6·5 c.m., but of course the size of the hole is regulated by the size of the hand and wrist of the man for whom it is intended. The drawings herewith[*] give a very good idea both of its general shape and the method of wearing it. An examination of these objects seems to emphasize a remark of Forster's[†]:—"They were all remarkably slender. . . . Their limbs were indifferently proportioned, their legs and arms long and slim." The average European would find it impossible to put on the average Malekulan "onvar." However, in this respect the Malekulese are not peculiar amongst the lower races.

Supplementary Note.—Since writing the above I have obtained further information from Rev. T. Watt Leggatt, of Malekula. The simple spiral band mentioned as being used in the islands to the north is also common in Malekula, together with a simpler form, consisting merely of the mid-rib of a banana leaf twisted round the wrist. The form figured is worn loosely as a rule; but when fighting is imminent it is laced tightly with a grass fibre.

Further, Mr. Leggatt has investigated the name usually given for the guard, viz., "*onvar.*" He discovers that the correct title in the Aulua district (Port Sandwich) is *nehonvar*, derived from *nehono*, the face, and *verna*, the hand—*ver* or *var* being the root for hand, as *verangk*, my hand; *verim*, thy hand; *verna*, his hand. The word really means the face of the hand, *i.e.*, the thing that stands before the hand to protect it.

In the Maskelyne Group, south of Malekula, the guard is called *nahonva.* In Pangkumu it is named as at Aulua. In the Uripio district the word used is *bekver*, the derivation of which Mr. Leggatt has not been able to discover (*Sept. 28th, 1901*).

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[*] For which I am indebted to Mr. Chas. Hedley.

[†] G. Forster, *l.c.*, p. 206.

NOTES ON AN ABORIGINAL GRAVE IN THE DARLING RIVER DISTRICT, N.S.W.

By Graham Officer, B.Sc.

(Communicated by R. Etheridge, Junr.)

(Plate xiii.)

Certain objects of aboriginal manufacture, found over a large area of the Western Division of N.S. Wales, have hitherto been somewhat of a puzzle to science, precise information about them being difficult to obtain. The only published matter on the subject is contained in a paper by Mr. W. R. Harper,* but to which at the time of writing I have not access.

During two and one-half years' residence on Kallara Station, between Bourke and Wilcannia, on the Darling River, I have collected a number of these objects, which may be divided into two main groups:--

(A) Those of the first type are the most commonly occurring, and are those which Mr. Harper has already described. The material of which they are made is sometimes stone, such as quartzite. In some cases a conveniently shaped pebble has been used, and I have a specimen which makes me think they were sometimes dressed out of a rough oblong block. But perhaps the most frequently occurring specimens have been made of kopi, an earthy gypsum which is first burnt and then mixed to form a cement with sand and water, moulded to the required shape, and afterwards evidently finished by scraping.

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* Harper (W. R.)—"A Description of certain Objects of unknown Significance, formerly used by some New South Wales Tribes." Proc. Linn. Soc. N.S. Wales, 1898, xxiii, p. 420.

In shape and form the specimens of the A type vary much in detail, although the general form is well marked. Generally they are about 12″ more or less in length, round in section. The proximal end is from 1½″ to 2″ in diameter, and is hollowed out slightly. This feature is invariable. The distal end terminates in a blunt point. In some cases the body or shaft is of the same diameter about where the narrowing to the point begins; in other cases the body swells to its greatest diameter about the middle of its length. Some are straight, others have a slight bend; some are flattened on one side, and most have certain incised markings on them, generally various combinations of short lines.

(B) The specimens of this type are quite distinct from those of type A. So far as I have seen, they are invariably made of kopi. They are of about the same length as the A specimens, but broader and flattened in section, while in shape they are more or less oval. On one side they are convex and on the other flat, and some are pointed, especially at one end; some have a slight bend, the flat side forming the interior of the bend.

There can be no doubt but that the "stones" of the A type were placed over graves. Although I have never seen them in this position myself, having generally found them lying about or in the vicinity of sandhills, yet several gentlemen who have lived for many years in the district have assured me that they have frequently seen them placed on graves immediately after the interment. Mr. — Hatten, Stock Inspector of Bourke, formerly of Yanda Station, and who has been on the Darling for forty years, tells me that the number varied considerably. Sometimes only two, sometimes seven or eight, would be put on the grave. Mr. — Goddard, of Yandilla, says he has seen as many as twelve or thirteen on a grave, and that they were always placed in a circle, the blunt or proximal ends being stuck in the sand, and the distal ends pointing inwards slightly.

In November, 1900, Mr. Goddard, having discovered a grave with "stones" still *in situ*, I went with him to investigate it. It was situated on Curronyalpa Station, on a sandhill, about three miles back from the river (Darling). The site of the grave was marked by a large number of "stones" of the B type, arranged in a circle about three feet in diameter. I photographed the grave from two positions before disturbing it (Plate xiii.).

The "stones" were originally, in all probability, at least two deep, *i.e.*, there was an inner circle with an outer in close contact. They were placed on end, with the more pointed ends sloping slightly inwards. On proceeding to dig, we found that there were more "stones" below arranged like those on the surface. It appeared as if a mound had been originally made over the grave, and the "stones" placed or built up around it. On the east side there were in all three tiers, one above the other, the upper ends of the outer overlapping the lower ends of the inner. We found a skeleton about four feet from the surface, and situated to one side (the east side) of the circle above. I am unable to say whether this is accidental or by design.

I have seen a number of aboriginal graves, and in no case have I ever seen the body placed as this one was. The trunk was on its back, with the head turned to one side (the east). The arms were drawn up, one on either side of the head. The legs slanted upwards, so that the feet came within eighteen inches of the surface, and they were crossed about the knees. The body had been evidently enclosed in some vegetable covering, but the material was so decomposed—almost carbonised in places—that it was impossible to make out its original composition with certainty. However, it looked like the bark of some small tree, such as mulga or leopard-wood.

As already noted, the skeleton was placed slightly to one side (the east) of a vertical line from the centre of the circle of "stones" above, and it should be noted that at the arc of the circle towards the east, and corresponding with the position of the head of the skeleton, the "stones" were three deep. Mr. Goddard tells me that in the graves he has seen, the circle of "stones" was always placed over the head of the corpse.

The total number of "stones" on the grave I have described was thirty-nine, and there is considerable difference in size among them. Some seem to have lost much of their original bulk by the action of weathering. I have preserved the best of them, which will be forwarded to the Australian Museum.

The bones of the skeleton were very decomposed, and most of them crumbled away on being touched. However, I secured a tibia, portions of a humerus, upper and lower jaws and pelvis, which I have handed over to Mr. R. Etheridge, Junr.

There can now be no doubt, as I think, but that both types of the objects under discussion are grave-stones, and the question now arises, "What determined their respective uses?"

The Rev. — Morgan, Presbyterian clergyman at Bourke, told me that he was informed by an old blackfellow that the "stones" of type A were placed only on graves of men, while those of type B were placed on graves of women. If this be so, it would seem that these objects had a phallic significance, which has indeed been surmised in the case of type A.

The skeleton in the grave above described is that of a young person, the epiphyses of the humerus and femur at the proximal ends not being united. The small size of the bones and small development of the roughness and ridges for muscular attachment, as well as the state of the teeth, indicate the same conclusion. Being at sea while writing this, I am unable to say if Mr. Etheridge has been able to determine the sex or not. The fact that none of the front teeth in the upper jaw are missing would point either to the conclusion that the subject was a woman, or too young to have been admitted to the rights of manhood.

Mr. Hatten and Mr. Goddard both emphatically state that they have seen the A stones placed over men's graves, but do not recollect seeing them on women's graves.

I am thus inclined to the tentative conclusion that the peculiar objects under discussion have a phallic significance; that those of the A type were used to mark the graves of men, while those of the B type were placed on graves of women, and perhaps on graves of youths who had not attained their tribal majority.

AUSTRALIAN *PSYLLIDÆ.*

PART II.

BY WALTER W. FROGGATT, F.L.S.

(Plates xiv.-xvi.)

iii. Subfamily PSYLLINÆ.

Front of head either swollen or produced into two conical processes; eyes prominent. Stalk of cubitus shorter than stalk of subcosta.

Genus i.—CALOPHYA, F. Löw, Verh. Zool.-Bot. Gesell. Wien, xxviii., 1879.
ii.—DIAPHORINA, F. Löw, *loc. cit.*
iii.—PSYLLA, Geoffroy, Hist. Ins. 1762.
iv.—**AMBLYRRHINA, F. Löw,** ***loc. cit.***
v.—SPANIONEURA, Först, Rheinl. w. Westphal. Verh. 1848.
vi.—ARYTAINA, Först, *loc. cit.*
vii.—LIVILLA, Curtis, Brit. Ent. Vol. xiii., 1.
viii.—FLORIA, F. Löw, *loc. cit.*
ix.—ALLOEONEURA, F. Löw, *loc. cit.*
x.—HOMOTOMA, Guérin.
xi.—ANOMONEURA, Schwarz.
xii.—FREY-SUILA, Aleman, La Naturaleza (2), i. 1887.

This group contains a number of small species which lead a free life in the larval and pupal states, neither constructing lerp-scales nor producing galls upon their food plants. Some of them are perfectly naked, but others are enveloped or sheltered under a flocculent or woolly exudation, or surrounded with filaments of a woolly or waxy nature produced from glands along the outer margin of the body. The wattles (Acacias) are very rich in these insects, several of them having two or more peculiar species; so that the range of many is probably as wide as the distribution of the host plants. The eggs are generally laid all over the tips of the young foliage, or if on the branchlets thickly encrusting them, with the larvæ, pupæ, and perfect insects all crawling about on the same branch. In some cases these are so numerous that at first sight they look like aphides.

Judging from the numbers obtained in New South Wales where these insects have received most attention in this country, Australia will be found to be the richest region in this group of the Homoptera.

E. H. Rübsaman has described a new species (*Pauropsylla udei*) from Sumatra* the larva of which produces a gall, and is exactly like the typical *Trioza* larva from his drawings, but the perfect insect, also figured, belongs to the *Psyllinæ*. He also figures several other *Trioza* larvæ from Africa, and another from South America, but does not name them.

Genus PSYLLA, Geoffroy.

Head triangular, transverse; face lobes convex, conical; eyes semiglobose, prominent; antennæ slender, first two joints thickest. Thorax with front margins acute. Legs stout. Wings broad, rounded at apex, stigma distinct; stalk of subcosta longer than stalk of cubitus; radius stout, seldom curving downward to any distance; wings frequently semiopaque and sometimes spotted; nervures stout.

PSYLLA ACACIÆ-PYCNANTHÆ, n.sp.

(Plate xiv., fig. 5.)

Larva reddish-yellow, thickly mottled with black; antennæ, legs and wing-covers slightly mottled with fuscous; centre of abdomen tinged with red, outer margins fringed with long hairs.

Pupa similar in colour, but with the markings more defined; antennæ yellow, with apex of 3rd, 5th and whole of apical joints

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* Mitteilungen über neue und bekannte Gallen, 1899.

fuscous. Head very large, broad, rounded in front, sloping on sides; rounded behind, showing distinct median suture through centre; antennæ standing out straight in front, moderately long, slender. Thorax short, almost square, showing median suture with four spots on either side. Wing-covers large, swelling out, rounded on sides. Legs short, stout. Abdomen short, broad, rounded to apex, basal segments banded with, and the whole of apical segments fuscous.

Imago.—Length 0·0625, antennæ 0·03 inch. General colour dull brick red to reddish-brown, mottled with black; antennæ fuscous; face-lobes black at base, tips white, beneath all white; front of head and segmental divisions of thorax black, with a slight pubescence over antennæ, head and prothorax; legs fuscous, with tibiæ and tarsi pale ochreous; mesonotum marked with four parallel dark brown bars; scutellum pale yellow; abdomen mottled with black at base, bearing five broad black bands; wings semi-transparent, slightly clouded ; nervures light brown : ventral surface black, with abdominal bars white. Head with eyes as broad as thorax, narrow, deeply cleft and lobed in front, with the sides sloping down to front of eyes, slightly rounded on the sides, deeply arcuate behind; a distinct median suture, and fovea on either side. Face lobes short, broad at base, deeply cleft, and conical at tips; clothed with grey hairs. Antennæ very long and slender, tapering to the tips; 1st joint short, broad; 2nd very short; 3rd very long; 4th and 5th shorter; 6th-9th tapering, shorter; 10th short, truncate at apex. Eyes very large, prominent, as broad as the head, subglobular, compressed on the sides: central ocellus small, indistinct; lateral ocelli small, enclosed in a bright reddish patch close to hind margin of eyes. Thorax : prothorax angular in front, truncate at extremities, marked with two impressed spots; arcuate behind; dorsulum rounded on both sides, elongated at extremities; mesonotum large, convex, slightly arcuate in front, rounded on sides to apex; scutellum small. Legs long, thighs thickened; tibiæ slender, hind legs stouter than preceding ones, tarsal joints large. Wings thrice as long as broad, rounded at tips; primary stalk long; stalk of subcosta long, costal cell elongate; stigma long and slender; radius short, straight, running out above tip of wing; stalk of cubitus very short, upper branch of cubitus long, upper and lower forks nearly of equal length; lower branch of cubitus rather long, upper fork curving round; lower branch very short, curving inwards; clavus short. Abdomen large, narrow at base, swelling out and tapering to tip. Genitalia: (♂) lower genital plate elongate, rounded at tip; forceps broad at base, pointed at apex; upper valve slender at tips, curving over towards forceps: (♀) very short, broad, rounded at apex.

Hab.—Cheltenham, Victoria (on *Acacia pycnantha;* C. French, Junr.).

The only specimens of this species that I have seen were upon the large stout leaves of this Acacia. The eggs were scattered about singly, and there did not appear to be many specimens upon each leaf.

PSYLLA LIDGETTI, Maskell.

Trans. R. Soc. S. Aust. 1898, p. 5, pl. i., figs. 1-4.

This species was named from specimens sent to Mr. Maskell by Mr. Lydgett who found them on *Acacia implexa* at Myrniong, Victoria, a wattle which does not grow about Sydney.

This is a brown-coloured psylla with irregular patches of reddish-yellow, the antennæ and feet yellow; eyes red. The wings are clouded in a different manner from any of the species of this genus that I have examined, and it is probably a local species like many of the others.

Mr. Lydgett has promised to send me some specimens of this *Psylla*, but up to date I have not received them.

PSYLLA FRENCHI, n.sp.

(Plates xiv., fig. 4; xvi., fig. 2.)

Pupa.—General colour pale yellow, tinted with green; antennæ, legs, blotches on head, wings and wing-covers light brown; eyes reddish-yellow; thorax with eight black spots forming a circle on the back; abdomen green, upper segments marked with interrupted black bands, apical segments black. Head broad, slightly rounded in front, sloping to eyes, narrow behind them, arcuate behind. Antennæ long, slender, coming to a point at tip. Thorax broad, sloping back to abdomen. Wing-covers large, swelling out on side, pointed at apex. Abdomen constricted at base, swelling out, rounded to tip, bearing a patch of white wax-like secretion on anal segment.

Imago.—Length 0·01, antennæ 0·0225 inch.

General colour dull yellow, marked with light brown; terminal joint of antennæ, tarsi, and abdominal segments barred with black; eyes red. Wings semiopaque mottled with light brown; nervures light reddish-brown. Head very short, as broad as thorax, rounded in front, cleft in centre, with median suture, and dark fovea on either side, hind margin arcuate. Face lobes large, rounded at tip. Antennæ long, slender, 1st joint very broad, short; 2nd longer; 3rd very long; 4th-9th filiform; 10th slightly clubbed, truncate at apex. Eyes very large, projecting, semi-globular: central ocellus large, at apex of median suture; lateral ocelli large, close to hind margin of eye. Thorax: pronotum narrow, deeply wrinkled, with fovea in centre and on either side, convex in front; dorsulum large, arcuate in front, pointed at sides, arcuate behind; mesonotum large, convex, arcuate in front, broadly rounded on sides to hind margin; scutellum large. Legs stout, long; tibial spines large; tarsi long. Wings nearly thrice as long as broad, rounded at apex; primary stalk long; stalk of subcosta long, straight, forming a stout stigma joined to costal nervure; radius running close to subcostal, turning downward at extremity: stalk of cubitus short, curving downward; upper branch turning upward, upper fork turning downward: lower branch of cubitus curving downward to middle of wing, upper fork long, curving upward in a line with upper branch; lower fork short; clavus broad, stout. Abdomen stout. Genitalia (♂) short, broad; lower genital plate short, broad; forceps long, broader at base, slender, produced into finger-like processes, pointed at tips, fringed with fine hairs; penis long, slender; upper genital plate short, broad, truncate at apex, narrow at base, slightly rounded on the sides, and fringed with fine hairs.

Hab.—Colo Vale, N.S.W. (on *Acacia* sp.; W. W. Froggatt).

Dedicated to Mr. C. French, Junr., to whom I am indebted for several fine species. The larvæ form no lerp, but crawl about freely among the tips of the foliage, and do not even seem to form any secretion like others of the free-living species. They are never very numerous, but scattered all over the foliage.

PSYLLA ACACIÆ-PENDULÆ, n.sp.

(Plates xiv., fig. 1; xvi., fig. 13.)

Larva pale ochreous, eyes and centre of abdomen bright red. General form oval, thoracic segments cylindrical, flattened on dorsal surface. Head large, with fovea on either side; antennæ short, stout, eyes far back, above base of fore-legs. Abdomen broad, rounded, fringed with short spiny tubercles.

Pupa.—General colour light brown to pale yellow, sometimes tinted with red or green; apex of 3rd and the rest of the joints of antennæ and tibiæ black; sides of head, spots behind, a double row on thorax, wing-covers, and bands on abdominal segments brown. Head very large, rounded in front; antennæ seven-jointed, pointed at tips; eyes very large, projecting. Thorax very broad across, arcuate in front; wing-covers standing out on either side, short, and sharply rounded at apex; tarsi covered with fine hairs. Abdomen flattened, truncate at base, rounded on sides, segments deeply divided, wrinkled.

Imago.—Length 0·05, antennæ 0·02 inch.

General colour light brown, covered with a grey pubescence, apical joints of antennæ black; wings hyaline, nervures brown. Head long, deeply arcuate in front, with a deep median suture, and fovea on either side, sloping down to eyes, arcuate behind. Face lobes broad at base, rounded, short. Antennæ long, slender; 1st joint short, slightly curved; 2nd short; 3rd very long; 4th-9th uniform, slender; 10th short, tapering to tip. Eyes large, flattened on inner margin: central ocellus very small, at apex of median suture; lateral ocelli large, bright red, close to hind margin of eyes. Thorax: pronotum broad, convex in front, arcuate behind; dorsulum long, nearly truncate in front, somewhat angular at extremities; mesonotum large, convex, deeply arcuate in front, rounded behind; scutellum resting upon hind margin of mesonotum. Legs slender, tarsi long. Wings twice as long as broad, rounded at tips, slender at base, costal nervure stout, with subcostal forming a slender stigma: primary stalk long, curving upward; stalk of subcosta long, curving upward; radius long, curving upward, and running parallel with costal; stalk of cubitus short, upper branch of cubitus curving upward, upper fork long, turning downward, a little longer than lower branch, forming a long cell; lower branch of cubitus transverse, upper fork turning upward and then down; lower fork curving round to the base; clavus stout, thickened; clavical suture long, slender. Abdomen slender, yellow, with basal half of each segment on both dorsal and ventral surfaces barred with dark brown. Genitalia (♂) large, lower genital plate broad, rounded; forceps broad at base, bending over like two bent fingers; penis hidden; upper genital plate broad at base, rounded at apex.

Hab.—Pera Bore, Bourke, and Condobolin, N.S.W. (in each case upon *Acacia pendula;* W. W. Froggatt).

This species appears to be peculiar to the Weeping Myall (*Acacia pendula*) and probably ranges over the western country where this tree grows. This insect can be found in all stages of growth upon the twigs in November and December.

PSYLLA ACACIÆ-DECURRENTIS, n.sp.

(Plates xiv., fig. 7; xvi., fig. 5.)

Larva.—General colour bright orange-yellow, dorsal surface mottled with fuscous; legs and antennæ fuscous. Head very large, convex in front; with a faint median cleft running down centre to base of abdomen; antennæ very long, slender; eyes large, far back on sides of head. Thorax very small, legs long. Abdomen broad, rounded to apex, lightly fringed with hairs.

Pupa.—General colour bright reddish-brown; legs, antennæ, wing-covers, blotches behind eyes, two rows of spots down sides of thorax, two elongated bars at base, and whole of apical portion of abdomen dark brown. Dorsal surface thickly clothed with short spiny hairs. Head short, broadest at base, rounded in front and on sides; antennæ stout and very long; eyes small, angular on inner margins. Thorax rounded in front, swelling out on sides to base of wing-covers; the latter small, elongate, rounded at tips; legs stout, long, tarsi large. Abdomen large, swelling out at base, almost circular, last segment curving inwards, forming a lobe on either side of anus.

Imago.—Length 0·065, antennæ 0·0275 inch.

Ochreous thickly marked with chocolate and darker brown; antennæ from second joint to tip and eyes black; abdomen banded with black and red; wings opaque, thickly mottled with brown, and marbled with white, nervures ochreous. Dorsal surface clothed with fine grey hairs. Head small, nearly truncate in front, median suture distinct, arcuate at base. Face lobes very large, broad at base, coming to a conical tip. Antennæ very long, slender; 1st joint very short, broad; 2nd short, stout; 3rd long, cylindrical; 4th-9th shorter, uniform in length; 10th shorter, pointed to apex. Eyes rather small, projecting slightly on sides, angular on inner margins: central ocellus very small, at apex of median suture; lateral ocelli elongate, situated at upper margin of eye. Thorax: pronotum narrow, of uniform width, slightly broadest at extremities; dorsolum slightly convex in front, broadest in centre, tapering to a point at extremities, rounded behind; mesonotum large, convex on summit, arcuate in front, produced into a conical point on sides, rounded behind; scutellum arcuate in front, rounded behind. Legs long, thighs thick, tibiæ slender, tarsi long. Wings twice as long as broad, swelling out in front, slightly depressed in centre, swelling out broadly and rounded at apex; nervures very thick, especially the costal; primary stalk short, straight, stalk of subcosta long; subcosta running into costa forming a slender stigma; radius short, coming out on upper edge of wing; stalk of cubitus very short; upper branch of cubitus long, curving upward and then down, upper fork short, coming out below tip of wing; lower fork as long as upper; lower branch of cubitus transverse, upper fork curving round, long; lower fork short, curving sharply round towards base of wing; clavus stout, thickened; clavical suture very long. Abdomen broad, rounded on sides, red bands on dorsal surface, white on ventral. Genitalia: (♂) lower genital plate large, rounded; forceps slender, curved inward; penis slender, upper genital plate slender, broad at base, pointed at apex: (♀) upper and lower genital plates short and rounded.

Hab.—Richmond, Young, Wagga, N.S.W. (on *Acacia decurrens*; W. W. Froggatt).

The insects clustering all over the stems and branchlets of this wattle form no protective covering or secretion. The eggs, bright yellow and somewhat elongate in form, thickly coat the bark of the small branches; larvæ, pupæ and perfect insects crawl over the stem beneath. The very long antennæ, beautifully coloured wings and dark tints give this psyllid a striking appearance.

PSYLLA CAPPARIS, n sp.

(Plates xiv., fig. 6; xvi., fig. 14.)

Larva semitransparent to pale yellow, abdomen reddish-orange, eyes bright red; tip of antennæ black. Head very large, broad, rounded in front, lightly fringed with fine hairs; eyes far back on sides of head; a fine median suture running through head to base of thorax. Antennæ in front of head, tapering to tips. Thorax as broad as head but not more than one-half the length, forming two lobes on the sides. Legs stout, thick, and very hairy. Abdomen rounded to apex, each segment ornamented with a fine hair.

Pupa bright orange to pale yellow; apical half of antennæ, tibiæ and tarsi black; wing-covers, blotches on head, spots on thorax, interrupted bands on the base and apex of abdominal segments dark brown. Dorsal surface lightly clothed with fine men, the latter clothed with a mass of white filaments forming a white tufted tail General form that of larva, with head arcuate behind; wing-covers swelling out on sides, abdomen broad and rounded to tip.

Imago.—Length 0·045, antennæ 0·025 inch.

General colour greyish-brown to light ochreous, mottled and marbled with darker brown; antennæ black from third basal segment; abdomen bright yellow, apical margin of basal and whole of apical segments black; wings opaque, clouded with a greyish tint, thickly mottled with light brown, forming an irregular pattern towards apical edge; nervures light brown. Head narrow, rounded in front, slightly cleft in centre, rounded to eyes, with a slight median suture and small rounded fovea on either side, deeply arcuate behind. Face lobes broad at base, short, coming to a point at apex. Antennæ rather short, springing out in front of eyes; 1st joint short, broad; 2nd short; 3rd longest; 4th-9th of uniform length; 10th short, slightly thickened at tip. Eyes very large, prominent, semiglobular: central ocellus small, at base of median suture; lateral ocelli large, close to hind margin of eyes. Thorax: pronotum rounded in front, arcuate behind, with extremities rounded, and marked with a dark spot; dorsulum broad, slightly depressed on either side of front margin, coming to a point at extremities, hind margin irregularly rounded; mesonotum large, deeply arcuate in front, coming to a point on extremities, rounded behind: scutellum arcuate in front, rounded behind Legs short, femora stout and rounded; tibiæ short; tarsi small. Wings nearly twice as long as broad, narrow at base, curved on costal margin to broad rounded tip; primary stalk long, curving upward; stalk of subcosta long, subcostal nervure turning up and forming a stout opaque stigma; radius short, curving downwards, not reaching tip of wing; stalk of cubitus short, upper branch curving upward, then down; upper fork turning upward at tip, lower fork downward, each of about equal length: lower branch of cubitus short, not as long as lower fork, upper fork curving upwards, rounded to extremity; clavus short, slender; claval suture long, slender. Abdomen short, broad. Genitalia: (♂) large, turned over back, lower genital plate rounded, elongate; forceps broad at base, long, slender, rather straight; penis hidden; upper genital plate rounded at base, long, slender: (♀) short, broad, thickly clothed with hairs, which form quite a white tuft when viewed from above.

Hab.—Gunnedah, N.S.W. (on *Capparis Mitchelli;* W. W. Froggatt).

This species was found in all stages of development, from the bright yellow eggs to the winged psyllid, covering the underside of the leaves of this shrub, the infested foliage looking as if it had been coated with dust, from the number of larvæ and larval skins attached to the leaves. I have never seen this species except on this one occasion, but it probably has a wide range like its food plant.

PSYLLA CANDIDA, n.sp.

(Plates xiv., fig. 12; xvi., fig. 16.)

Larva dull yellow; tips of antennæ, spots on head and thorax black, eyes reddish-brown; entire dorsal surface fringed with fine hairs. Head small, rounded in front, broadest behind. Antennæ very long, eyes large. Thorax short. Abdomen long, oval to tip, marked with fine parallel striæ.

Pupa pale yellow, with last four joints of antennæ black, eyes light red; abdomen pale green, yellow at apex. Head rounded in front, arcuate behind. Antennæ long, slender, basal joints stout, apical ones tapering to tip. Eyes large, rounded, projecting. Thorax swelling out behind head. Wing-covers large, projecting beyond the base of abdomen. Legs short, thick. Abdomen oval, smooth, showing slender interrupted black bars at base of segments, fringed with very stout black hairs.

Imago.—Length 0·04, antennæ 0·01 inch.

General colour light ochreous, in some specimens head and thorax shaded with green; abdomen bright green; last two joints of antennæ black, eyes red; wings light brown, sometimes barred with darker tints, nervures dull yellow. Head narrow, rounded and slightly lobed in front, with a deep median suture, arcuate behind. Face lobes small, not showing from above. Antennæ long, 1st joint very stout, broad; 2nd short; 3rd longest; 6th-10th slightly swollen, rounded at apex. Eyes very large, projecting: central ocellus very small; lateral ocelli small, on summit of head. Thorax : pronotum broad and deeply convex in front, broad and arcuate behind; dorsulum convex, coming to a point at extremities, swelling out behind, convex at apex; mesonotum rounded in front; scutellum broad, arcuate in front, rounded behind. Legs short, stout. Wings long, slender, thrice as long as broad, curved in at base, costa straight to rounded tip; primary stalk long, stalk of subcosta long, subcosta running parrallel with costa forming a slender stigma; radius turning up at tip, not reaching apex of wing; stalk of cubitus short, upper branch of cubitus arching upward then down; upper fork curving down, emerging in centre of tip of wing, lower fork as long as upper, curving downwards; lower branch of cubitus long, upper fork curving round forming a long cell, lower fork short, turning outwards; clavus short, stout; clavical suture distinct. Abdomen short, swelling out at base, distinctly marked at segmental divisions, rounded on outer margins. Genitalia : (♂) short, broad, turned up over the back; lower genital plate long; forceps slender, forming two slender fingers; penis large; upper genital plate small, rounded to a point at apex.

Hab.—Termiel, Gosford, N.S.W. (on *Acacia decurrens*: W. W. Froggatt).

Tne larvæ and pupæ of this species attack the tips of the foliage of the Acacia, producing a quantity of white waxy filaments which mat the terminal leaves together in the same manner as do some of the mealy bugs. Under this secretion the larvæ feed and the pupæ cast their skins; the perfect insects crawl about on the foliage.

PSYLLA SCHIZONEUROIDES, n.sp.

(Plate xiv., fig. 3.)

Larva bright yellow, legs and antennæ fuscous, eyes bright red. Head rounded in front; antennæ stout, with a very long terminal bristle. Abdomen small in proportion to head and thorax, segmental divisions very distinct, dorsal surface covered with short hairs, with a fringe of longer ones round the pointed tip of abdomen.

Pupa bright yellow, but thickly covered with fuscous on the dorsal surface. General form very short and broad.

Imago.—Length 0·045, antennæ 0·015 inch.

General colour dark brown mottled with ochreous; antennæ fuscous, except 2nd-4th joints which are yellow; legs marked with yellow, tarsi black; wings opaque, richly mottled with light brown, forming a dotted pattern in centre but more blotched at edges; segmental divisions of the abdomen white. Head as broad as thorax, almost truncate in front, with a very slight median cleft and suture, two small impressed foveæ; somewhat angulated at base of antennæ, convex on hind margin. Face lobes large, very broad at base, coming to a point at tip, covered with long hairs. Antennæ short, hairy, springing from in front of eyes, 1st joint short; 2nd short, slender; 3rd longest; 4th-8th slender, shorter towards apex; 9th-10th forming a slight club rounded at apex. Eyes very large, prominent, standing out on the sides of head, angular on the inner margins: central ocellus at apex of median suture; lateral ocelli small, close to hind margin of head. Thorax: pronotum slender, of uniform width, curving round behind eyes; dorsulum slightly convex in front, coming to a point at extremities, sloping down on hind margin to truncate base; mesonotum deeply arcuate in front, swelling out on sides to a point at extremities, broadly rounded to base. Legs short, stout. Wings little more than twice as long as broad, narrower at base, broadly rounded to apex; primary stalk moderately long, stalk of subcosta long; subcostal nervure running close to costal, forming a slender stigma; radius curved upward, then turning downward, but emerging above tip of wing; stalk of cubitus short, upper branch of cubitus long, arching upward, upper and lower fork nearly of equal length, upper slightly longer, emerging below tip of wing; lower branch of cubitus short, upper fork long, curving upward and then down, lower fork rather long, curving inward; clavus short, clavical suture slender. Abdomen short, stout, coming to a conical point at tip. Genitalia: (♂) short, lower genital plate small, forceps short, upper genital plate small: (♀) very short, upper and lower genital plates short, pointed, covered with fine hairs.

Hab.—Condobolin, Carrathool, N.S.W. (on "Warrior Bush," *Apophyllum anomalum;* W. W. Froggatt).

This species probably has a wide range in the western districts where the "warrior-bush" grows. The eggs are clustered close together and frequently extend over an inch down the twig; they are so numerous that they tint the smaller twigs a bright yellow. The larvæ and pupæ discharge a white sticky secretion, which envelopes them in a greyish-white mass, exactly like that of the common woolly aphis (*Schizoneura lanigera*); beneath this the insects are almost as thick as the woolly aphis under similar circumstances.

PSYLLA STERCULIÆ, n.sp.

(Plate xv., fig. 13.)

Eggs bright yellow, short and more rounded than usual, laid in great clusters on the young foliage between the forks of branchlets. The young larvæ crawl close together, seldom moving at first, and are smothered with numbers of small black ants (*Leptomyrmex gracilis*).

Larva.—Head and thorax dull yellow, barred with light brown, eyes red; antennæ and legs semitransparent, the latter tipped with fuscous; abdomen reddish-yellow; entire dorsal surface lightly clothed with long hairs. Head and thorax conjoined, very broad, rather truncate in front, rounded behind. Antennæ short, standing on either side. Legs short, thick. Abdomen small, truncate at base, rounded on sides to apex.

Pupa similar in colour, except that the brown markings are much darker. Head not as broad as thorax; wing-covers small; abdomen much broader. Entire dorsal surface covered with short hairs bearing a sugary honey-dew.

Imago.—Length 0·045, antennæ 0·001 inch.

General colour ochreous, tinged with reddish-brown; head, prothorax and outer margins of dorsulum black; tips of antennæ and tarsi fuscous; front of dorsulum, sides of metanotum, hind portion of thorax and bands on upper portion, and apex of abdomen chestnut-brown; wings light brown, semiopaque, nervures darker. Head very narrow, turned down and rounded in front, deeply arcuate behind, with a slight median suture and shallow fovea on either side. Face lobes hidden from above. Antennæ very short; 1st-2nd joints very short; 3rd cylindrical, slender, long; 4th-9th short, rounded, decreasing in length to apex, 10th rounded. Eyes large, projecting, angular on inner margin: central ocellus hidden from above; lateral ocelli very small, in line with centre of eyes. Thorax: pronotum narrow, deeply curved in front, slender towards tips, not quite reaching to outer edge of eyes; dorsulum large, rounded on either side, toothed at extremities; mesonotum large, arcuate in front, rounded on sides, arcuate at junction with scutellum. Legs long; tibiæ long, slender; tarsi and tarsal claws large. Wing thrice as long as broad, curved at base, rounded at tip; costal nervure very stout; primary stalk very long; stalk of subcosta shorter than stalk of cubitus; subcosta running into costal nervure, forming a thickened slender stigma; radius straight, running out above tip of wing; stalk of cubitus long; upper branch of cubitus very long, upper and lower forks short, forming a small angular cell, upper one emerging in centre of wing, lower branch of cubitus short, upper fork long, curving round, lower fork nearly straight; clavus short, clavical suture slender. Abdomen small. Genitalia: (♂) curved over back, very hairy; lower genital plate large, rounded; forceps slender, upper genital plate short, rounded in front: (♀) abdomen large, swollen, genital plates forming an elongated tip, very hairy.

Hab.—Wagga, N.S.W. (on Kurrajong, *Sterculia* sp.; W. W. Froggatt).

This is a rare species; I have only found it in one place, on the kurrajongs at the back of the Experiment Farm at Bomen.

PSYLLA ACACIÆ-BAILEYANÆ.

(Plates xiv., fig. 2; xvi., fig. 3.)

Larvæ clustering round the tips of twigs, forming no lerp. General colour bright yellow, legs and antennæ fuscous at tips; eyes red. Head broad, rounded in front, longer than thorax. Antennæ long, hairy, standing out in front. Eyes large, well back on side of head. Thorax as broad as head, lobed on sides. Legs long. Abdomen large, rounded, oval, with tip ornamented with two fine hairs.

Pupa.—Head and thorax pale yellow to ochreous; tarsi and last three joints of antennæ fuscous; abdomen light yellow, shaded with green; eyes reddish-brown; two blotches on head, markings on thorax, wing-covers, transverse lines on upper abdominal segments and the whole of lower segments fuscous. Head small, rounded in front and on sides, not as broad as thorax, arcuate behind; antennæ long, slender, pointed at apex: eyes large, rounded, projecting. Thorax swelling out at base, wing-covers broad, rounded to tips; legs stout. Abdomen broad, rounded on the sides to apex, slightly truncate.

Imago.—Length 0·03, antennæ 0·0075 inch.

General colour dull orange-yellow, legs and antennæ fuscous at tips; abdomen pale green to yellow, barred with fuscous; thorax mottled with brown; wings grey, semiopaque, thickly covered with irregular brown spots; nervures light brown. Dorsal surface covered with a grey pubescence. Head small, deeply lobed in front, arcuate behind antennæ, rounded on sides, convex behind, with a median suture, and a small dark fovea on either side. Face lobes small, rounded, slightly hairy. Antennæ slender, 1st and 2nd joints rounded at apex, 3rd longest, 4th-8th uniform, 9th-10th thickened, rounded at tip. Eyes very large, projecting, rounded on outer margin, truncate on inner edge: central ocellus very small, hidden by the floury pubescence; lateral ocelli very small, situated near centre of inner margin of eye. Thorax: pronotum narrow, convex in front, with a dark fovea on either side near extremities; dorsulum slender, rounded in front, tapering to a rounded knob at sides, rounded behind; mesonotum large, slightly arcuate in front, swelling out, rounded on sides, slightly arcuate behind; scutellum small, broad. Legs long, slender, covered with fine hairs. Wings short, broad, not quite twice as long as broad, broadly rounded at tips; primary stalk long, turning upwards, stalk of subcosta slightly longer, subcosta running into costal nervure forming a distinct stigma; radius short, turning upward at the tip; stalk of cubitus short, upper branch of cubitus curving upward, then downwards; upper fork turning downward, longer than lower fork; lower branch of cubitus short, upper fork long, curving upward and then down, lower fork curving inwards; clavus stout, clavical nervure long, crossing the length of anal cell. Abdomen: (♂) slender, (♀) large, swollen. Genitalia: (♂) large, lower genital plate short, round at base; forceps very short, broad, blunt at tips, penis small; upper genital plate broad at apex, slender, bending over towards forceps, clothed with fine hairs; (♀) very short, broad, pointed at tips.

Hab.—Sydney, N.S.W. (on *Acacia Baileyana*, F.v.M.; W. W. Froggatt.)

The insects in all stages of growth cluster over the young branchlets of the Acacia, so that in the early summer the trees look as though they were infested with yellow aphides; they fly off in a cloud when disturbed. The eggs are slender, bright yellow, and scattered all over the foliage, among which the larvæ and young pupæ crawl about.

It is a curious fact that wherever this pretty, ornamental wattle is planted the psyllids appear. They swarm in my garden at Croydon, and I have seen them away out in the bush at Balmoral on the trees, and in several other localities, so that the range of the species is probably that of the food plant.

Genus MYCOPSYLLA, n.g.

Head deeply cleft in front; face lobes wanting; eyes very large, antennæ very large, slender. Thorax with pronotum not as wide as head, narrow. Legs long, slender. Wings nearly thrice as long as broad, glassy transparent, acute at extremity; stigma distinct; radius very short, turning upward; stalk of subcosta longer than stalk of cubitus; furcations of upper arm of cubitus forming an angular cell at tip of wing. Legs long, slender. Abdomen narrow at junction with thorax, broad behind, tapering to tip.

Type *Psylla fici*, Tryon.

MYCOPSYLLA FICI, Tryon.

Psylla fici, Tryon, Trans. Nat. Hist. Soc. Queensland, Vol. i., 1892-4, p. 60.

(Plates xv., fig. 7; xvi., fig. 17.)

Eggs deposited in patches of about 50 upon the underside of leaves, close together, but not in contact; dark reddish-brown, finely granulated; oval, pointed at the extremities, showing a straight parallel ridge or keel of lighter colour along the dorsal surface.

Larva.—First stage: pale yellow, eye-spots brown; general form oval, with a flange round body; segmental divisions distinct; clothed with short hairs forming a fringe round outer margins, a pencil of white wax-like secretion cleft at tip projecting from above tip of abdomen. Second stage: dull white to pale yellow, entire upper surface of head (except median suture), four large angular blotches on thorax, wing-covers, four interrupted bands on basal and apical portion of abdominal segments black; eyes bright orange. Head broad, oval; antennæ very short forming a curved horn in front of eyes; eyes not projecting. Thorax swelling out behind eyes, rounded at base; wing-covers short, broad, standing out, rounded to tip of abdomen; lightly clothed with short hairs. Ventral surface pale yellow; basal portion of legs, tip of rostrum, four slender bars on the upper and whole of the apical segments of abdomen fuscous; tibiæ and tarsi ochreous.

Pupa.—General colour as in last stage of larva, only the colouration much lighter, and tinged with yellow; abdomen pale green. Head lobed in front, swelling out behind eyes, truncate at base;

antennæ short, thick, pointed at apex, curving round sides of head. Wing-covers reaching beyond base of abdomen; the latter short, rounded, anal segment with a stout conical tubercle on either side.

Imago.—Length 0·135, antennæ 0·06 inch.

General colour ochreous-yellow; apex of basal, the whole of the apical joints of antennæ, outer margins of head, thorax, and abdominal segments clouded with fuscous, thorax also shaded with orange; eyes red; ocelli orange. Wings hyaline, nervures ochreous. Head very broad, twice as wide as long, deeply cleft and angulate between base of antennæ, rounded on sides, arcuate behind. Face lobes wanting. Antennæ springing from either angle of head, long, slender; 1st joint very stout; 2nd narrow at base; 3rd very long, cylindrical, narrow at base; 4th-7th of uniform girth, but decreasing in length to tip; 8th much shorter, swollen at tip; 9th shorter, swollen; 10th very short, swollen, truncate at tip. Eyes very large, occupying the whole side of the head, rounded on outer margin: central ocellus placed at base of median cleft; lateral ocelli close to hind margin of eye. Thorax: pronotum not as broad as head, curved, slender; dorsulum very convex, rounded in front, sloping down on sides, rugose on edges, rounded behind; mesonotum broad, arcuate on front and sides, hind margin truncate; scutellum convex, slightly arcuate in front. Legs long, stout, lightly clothed with hairs. Wings thrice as long as broad, rounded to a point at apex; primary stalk long, curved down in centre, clouded with fuscous along upper edge; stalk of subcosta long, curving inward, straight above; subcostal nervure long, close to costal, forming a distinct stigma; radius very short, turning up beyond tip of stigma; stalk of cubitus very short, upper branch of cubitus long, nearly straight, upper fork turning upward above tip of wing, lower fork turning down below tip of wing, thrice the length of upper fork; lower branch of cubitus turning downward, upper fork long, curving round; lower fork shorter, curving inwards to base of wing; clavus stout, curved; clavical suture slender, running through lower portion of cell. Abdomen long, slender, constricted at base, round to apex. Genitalia: (♂) short, broad, lower genital plate rounded to a point; forceps short, narrow at base, swelling out and deeply arcuate at extremities, upper genital plate forming curved short fingers; (♀) short, broad, very hairy; tips of valves coming to a sharp point.

Hab.—Sydney, N.S.W (W. W. Froggatt); Brisbane, Q. (H. Tryon; in both localities on the Moreton Bay Fig, *Ficus macrophylla.*)

This psyllid seems to range wherever the Moreton Bay Fig grows. The larvæ by piercing the upper surface of the leaves, cause the sap to flow out into little buttons which coagulate into regular folds and run together into a sticky mass, sometimes covering a score or more of pupæ. These remain under the covering until fully developed, when they crawl out and emerge from the pupal skin which remains attached to the leaf, so that when this is badly infested the mass of dried coagulated sap is surrounded with cast pupa-cases.

Mr. Tryon described only the eggs and larva of this insect in his short account of "Two insect pests of the Moreton Bay Fig" under the name of *Psylla fici.*

MYCOPSYLLA PROXIMA, n.sp.

(Plate xvi., fig. 8.)

Larva bright yellow, thickly mottled with black spots like the preceding species on the head, but with the thoracic spots forming a large blotch on the wing-covers; two large elongate marks on first four abdominal segments, 5th with a band across, apical ones all black. General form irregularly rounded, obese, and nearly as broad as long; legs and antennæ not visible when viewed from above; anal segment of abdomen arcuate at tip, with a tubercle on either side.

Pupa.—General colour pale green; legs and antennæ pale ochreous, dorsal marking as on larva, but those on head and thorax reddish-brown. Short, broad in form, clothed with fine hairs, and a white secretion that rubs off easily.

Imago.—Length 0·115, antennæ 0·0475 inch.

General colour green, dorsal surface of head and centre of thorax black, 1st segment of abdomen pale yellow, the rest dark green, anal segment and genitalia yellow; wings hyaline, nervures ochreous except primary stalk and subcosta which are black. Head as in the preceding species, but 3rd joint of antennæ more spindle-shaped, fringed with fine hairs. Central ocellus very small; lateral ocelli well up on side of eyes. Thorax: pronotum and dorsulum very narrow, the former curving round the latter, widest at extremities. Wings as in the preceding species, but the stigma more slender, lower fork of upper branch of cubitus longer, and upper fork of lower branch longer and more rounded. Abdomen of same form. Genitalia (♂) of same general form, with upper genital plate much more curved and hooked.

Hab.—Sydney, N.S.W. (on *Ficus rubiginosa;* W. W. Froggatt).

This species is closely allied to the Moreton Bay Fig insect, but is quite different enough to form a new species. The larva and pupa are very different in form and colouration and in habits. The larva always forms a solitary button of sap, under which seldom more than one seeks shelter, the outer surface of the exuded sap being covered with the fine hairs on the under surface of the leaf, and never forming a large irregular mass as on the foliage of *F. macrophylla.*

Genus EUCALYPTOLYMA, n.g.

Head broad, deeply arcuate behind. Face lobes large, rounded at tips. Eyes very large, prominent. Antennæ short, apical joints slightly swollen. Thorax: pronotum variable. Wings rounded at extremities, stalk of subcosta longer than stalk of cubitus; subcosta without stigma, running parallel with costa, forming a long slender tail to marginal cell; radius long, turning down at apex.

Type *Eucalyptolyma maideni.*

EUCALYPTOLYMA MAIDENI, n.sp.

(Plates xiv., fig. 9; xvi., figs 11, 20.)

Lerp white, opaque, granulated, 3 lines in length, 2½ wide at flattened, forming an elongate horn-shaped piece of sugar with a narrow open lace-like strip running down each side; broad end of lerp open, forming a flat-roofed chamber in which the larva hides with its head at the opening. The leaves of infested trees are literally covered with these lerp-scales, which are very brittle and crack off in the sun or are washed off by rain very quickly

Larva pale orange-yellow, legs and antennæ semitransparent, the latter tipped with black; eyes dark yellow. Front of head to tip of abdomen of uniform width; abdomen somewhat heart-shaped. Back and outer margins fringed with fine hairs, which generally carry minute globules of the white sugary secretion used in constructing the lerp-scale.

Pupa.—Head and abdomen bright green; thorax pale yellow; wing covers, legs, antennæ, spots between eyes, thorax, and upon abdomen brown. Head large, lobed in front, constricted at base; antennæ short, stout, fringed with long hairs; eyes large, projecting. Thorax long, sloping on sides to wing-covers, the latter small; legs short, stout. Abdomen large, narrow at base, broad, oval to tip.

Imago.—Length 0·06, antennæ 0·0125 inch.

General colour bright green tinged with yellow at base of thorax, and on genitalia; antennæ, eyes, and legs light brown, tips of first joint of tarsi and centre of eyes black; wings hyaline, nervures dark brown. Head broad, arcuate in front, rounded on sides, deeply arcuate behind. Face lobes large, close together, rounded at tips, clothed with fine hairs. Antennæ short; 1st joint very thick; 2nd broad, short; 3rd long, slender; 4th-8th uniform in length; 9th-10th shorter, the latter elongated, rounded at apex Eyes very large, hemispherical, projecting: central ocellus small, at apex of median cleft; lateral ocelli small, close to hind margin of eyes. Thorax: prothorax produced in front into a stout angular point fitting into back of head, the extremities forming a rounded lobe behind the eyes; dorsulum rounded on summit, not as wide as head, lobed on sides; mesonotum large, arcuate in front, rounded behind; scutellum small, flattened.

Legs short, stout. Wings more than twice as long as broad, broad, rounded at tips; primary stalk long; stalk of subcosta longer than that of cubitus, subcosta running parallel to costa forming a long narrow cell but no stigma; radius very long, curving round at extremity to tip of wing; stalk of cubitus short, upper branch of cubitus long, almost straight, upper fork curving sharply downwards, lower fork of about equal length; lower branch of cubitus rather long, upper fork short, rounded, lower fork very short, transverse, slightly turned in at tips; clavical suture distinct. Abdomen stout. Genitalia (♂) long, upper and lower genital plates long, slender, when closed appearing like a duck's head.

Hab.—Botanic Gardens, Sydney, N.S.W. (on *Eucalyptus* sp.; W. W. Froggatt).

I have named this after Mr. J. H. Maiden, who has helped me on many occasions since I took up the study of this family, with notes, references and specimens.

EUCALYPTOLYMA ERRATICA, n.sp.

(Plates xiv., fig. 8; xvi., fig. 21.)

Lerp white to pale yellow, formed of a brittle sugar-like secretion which cracks or washes very readily off the leaves, commencing at a point, attached along the outer edges of leaf, swelling out, and shaped like a small flattened horn: 4 lines in length, 1¼ in width at open base; scattered all over the underside of leaves.

Larva pale yellow, hiding under lerp, but coming out and running about over the foliage.

Pupa pale yellow; antennæ darkest at tips, legs brown, a dark mark on either side of thorax, wing-covers margined with brown. Head small; antennæ and legs short; wing-covers small, pointed at tips. Abdomen very large, narrow at base, swelling out to apex, elongate, oval, marked with impressed spots along the sides of dorsal surface.

Imago.—Length 0·0475, antennæ 0·0125 inch.

General colour deep yellow, eyes black, apical joints of antennæ light brown. Wings semitransparent, slightly clouded with brown, nervures light yellow. Head broad, deeply lobed, with a median suture, and a large fovea on either side; sloping down on sides to eyes, deeply arcuate behind. Face lobes very large, long, rounded at tips, turned down under head. Antennæ short; 1st joint broad, short; 2nd longer; 3rd-8th slender, of uniform length; 9th-10th forming a rounded club. Eyes very large, standing out on sides of head, somewhat reniform: central ocellus small, hidden from above; lateral ocelli small, very close to hind margin of eyes. Thorax: pronotum narrow; dorsulum slightly rounded in front, convex behind; mesonotum large, arcuate in front, rounded on sides and apex; scutellum small. Legs long, slender, tibial spines on hind legs very prominent, tarsi small. Wings more than thrice as long as broad; narrow at base, rounded in front to a broadly rounded tip; slightly arcuate on hind margin; primary stalk long, straight; stalk of subcosta long; costal nervure running close to costa, forming a slender cell but no stigma; radius long, curving downward to tip of wing; stalk of cubitus short, upper branch of cubitus curving upward then down, upper and lower forks of about same length, both turning downward; lower branch of cubitus long, upper fork curving round, lower fork very short, curving inward; clavus short. Abdomen small. Genitalia: (♂) very large; lower genital plate short, rounded; forceps very long, straight, slender, lightly fringed with hairs, and curved at tip; upper genital plate very long, thicker, and rounded at tip: (♀) short, broad, upper and lower genital plates forming a blunt point.

Hab.—Mosman Bay, and Sydney, N.S.W. (on *Eucalyptus corymbosa;* W. W. Froggatt).

This species, in the structure of the lerp chamber and habits of the larva, is closely related to *E. maideni.* The lerp scale is like the central part of the former without the scroll-like network ornamenting the sides.

Genus ERIOPSYLLA, n.g.

Head broad, cleft in front; face lobes short, broad, hairy; antennæ short; eyes reniform. Thorax: pronotum slender, curving round. Wings coriaceous, long, thrice as long as broad, rounded at extremities; no true stigma; subcosta running parallel to costal nervure forming a slender tail to the marginal cell; stalk of subcosta longer than stalk of cubitus; radius long; legs stout.

Type *E. viridis*.

ERIOPSYLLA VIRIDIS, n.sp.

(Plate xvi., fig. 6.)

Pupa pale green, with eyes, blotches on head, tips of antennæ, wing-covers, and apical portion of abdominal segments light brown. Head broad, somewhat rounded; eyes small; antennæ short, fringed with fine hairs, pointed at tips. Thorax fitting close on to base of head, as broad as abdomen; legs stout, with apex of tibiæ and tarsi fuscous. Abdomen oval, rounded at apex.

Imago.—Length 0·0475, antennæ 0·0125 inch.

General colour bright green, legs and antennæ pale green, eyes silvery grey; wings horn-colour, opaque, finely reticulated, nervures yellow; genitalia yellow, tipped with red. Head broad, rounded in front, slightly cleft, with a median suture, hind margin arcuate. Face lobes broad, rounded at apex, clothed with fine hairs. Antennæ very short, composed of very short joints, broadest at apex, and constricted at base; 10th joint elongate-oval. Eyes large, reniform, not projecting: central ocellus small, indistinct; lateral ocelli small. Thorax: pronotum narrow, wrinkled, and curled up on edges; dorsulum elongate, truncate in front, rounded behind; mesonotum somewhat flattened, arcuate in front, rounded on sides; scutellum narrow, truncate in front, rounded behind. Legs stout, tibiæ slender, tarsi large. Wings thrice as long as broad, narrow at base, sharply rounded to tip; primary stalk long, stalk of subcosta long; subcostal nervure long, running parallel to costal, nearly reaching tip of wing, forming no stigma; radius long, curving upward, and turning down at tip of wing; stalk of cubitus short, upper branch of cubitus long, upper and lower forks long, lower shortest, lower branch of cubitus half as long as upper; upper fork long, curving downwards, lower fork curving inward: clavus long, slender; clavical suture very slender. Abdomen broad, short, lightly barred with yellow on sides. Genitalia (♂) slender, lower genital plate elongate, forceps stout at base, curving up into finger-shaped tip: upper genital plate slender, curving over to tip of forceps.

Hab.—George's River, near Sydney, N.S.W. (on *Melaleuca linifolia*; W. W. Froggatt).

The larvæ and pupæ cluster upon the tips of the young growth of this shrub, enveloped in a slight fluffy white secretion, and are generally scattered over an infested bush in small colonies.

ERIOPSYLLA GRACILIS, n.sp.

(Plates xiv., fig. 11; xvi., fig. 9.)

Larva bright yellow, antennæ, legs, and apex of abdomen semitransparent; tarsi and tips of antennæ fuscous, eyes bright red. Head very large, rounded, lobed, parallel on sides, truncate behind; antennæ short, thickened at base, coming to a point at tips. Thorax not as long as head, but of uniform width; lobes of wing-covers projecting slightly on sides; legs short, stout. Abdomen constricted at base, swelling out to same width as thorax, rounded to tip, fringed with fine feathery filaments, each with a globule of honey-dew at its apex.

Pupa.—General colour dull white to pale yellow; two broad blotches on head, antennæ, legs, spots on thorax, wing-covers, three interrupted bands on basal segments, and the whole of the apical portion fuscous; eyes purple. Head large, rounded in front, arcuate in front of eyes, sloping in on sides, truncate behind; antennæ short, standing out at an angle from sides of head; eyes large. projecting, rounded in front, angulated on inner margin. Thorax and abdomen of uniform width, short and broad, the latter rounded to apex; wing-covers large, broad, rounded to apex; legs short, stout. Wing-covers and apical edge of abdomen fringed with white wax-like filaments.

Imago.—Length 0·03, antennæ 0·0075 inch.

General colour deep yellow, finely barred with black on thoracic and abdominal segments; apical joints of antennæ fuscous, eyes light reddish-brown ; wings semiopaque, coriaceous, slightly clouded with yellow, nervures pale brown. Head broad, with a frontal cleft, median suture, and fovea on either side; rounded in front, arcuate behind antennæ, swelling out, and rounded at eyes. Face lobes short, deeply divided, rounded at apex, clothed with fine hairs. Antennæ short, springing from front of head, and curving round on sides: 1st-2nd joints short, thick; 3rd longest, slender; 4th-9th slender, uniform; 10th not quite as long, rounded at apex. Eyes large, projecting, reniform: central ocellus very small, at apex of median suture; lateral ocelli large, close to front margin of eyes. Thorax: pronotum very slender, curving round, and impressed with five foveæ; dorsulum spindle-shaped, broad in centre, tapering to extremities; mesonotum large, arcuate in front, swelling out on sides, rounded and sloping round to hind margin, arcuate in centre of hind margin; scutellum broad, rounded behind. Legs stout, tibiæ slender. Wings long, slender, thrice as long as broad, rounded at tip; primary stalk long; stalk of subcosta longer than stalk of cubitus; subcosta running parallel with costal nervure forming a narrow cell, but no stigma; radius long, straight, running out above tip of wing; stalk of cubitus short; upper branch of cubitus long; upper fork short, running out at tip of wing, lower fork about same length, turning down; lower branch of cubitus long, upper fork very long, curving round to cubital fork, lower fork very short, nearly transverse; clavus stout, clavical suture distinct. Genitalia: (♂) lower genital plate large, broad; forceps long, slender, turning upward; penis slender; upper genital plate broad at base, terminating in a slender pointed tip: (♀) broad at base, sabre-shaped.

Hab.—Hornsby, Botany, &c., N.S.W. (on *Eucalyptus capitellata*; W. W. Froggatt).

This is a rather common species with a wide range over the coastal districts of New South Wales. The larvæ and pupæ congregate at the extreme tips of the young foliage, and envelope it in loose white woolly filaments, among which they feed and pupate.

Genus SYNCARPIOLYMA, n.g.

Head very broad, short, sharply turned down, arcuate behind, very slightly cleft in front. Face lobes short, broad. Eyes very large, flattened. Antennæ short, slender, springing from cleft below eyes. Thorax: prothorax very short, deeply curved, reaching to inner margins of eyes; mesonotum very large, arcuate at tips behind eyes, forming a slight knob in front; scutellum very large. Legs slender, tibiæ of hind pair slightly swollen at apex. Wings thrice as long as broad, rounded at tips, stalk of subcosta short; stigma wanting, subcosta forming a slender open cell; radius long; cubital cells small.

Type *Syncarpiolyma maculata.*

SYNCARPIOLYMA MACULATA, n.sp.

(Plates xv., fig. 2; xvi., fig. 7.)

Pupæ pale yellow, eyes bright red. Head broad, rounded in front to hind margin of eyes, broad, truncate behind; antennæ long, standing out in front of head; eyes large, rounded, projecting on sides. Thorax broad at base, swelling out on sides; wing-covers projecting, rounded at tips. Abdomen constricted at base, swelling out, broadly rounded, coming to a point at apex, which is clothed with a brush of long stout hairs.

Imago.—Length 0·04, antennæ 0·01125 inch.

General colour light brown, with darker brown spots and markings; eyes red, margined with yellow, ocelli pale orange; spots upon thorax and scutellum black; wings light brown, semi-opaque, coriaceous, lightly spotted with black, nervures clothed with fine hairs. Head short, wide between eyes, lobed in front, with a deep median suture, and a large fovea on either side; hind margin deeply arcuate. Face lobes very small. Antennæ short, slender: 1st joint stout; 2nd short, cylindrical; 3rd very long; 4th-6th shortest; 7th-8th slightly longer; 9th-10th short, swollen. Eyes very large, projecting: central ocellus at apex of median suture, lateral ocelli close to hind margin of eye. Thorax: pronotum narrow, marked with four black spots; dorsulum slender, rounded in front, broadest in centre, tapering to extremities; mesonotum large, convex, with a fine spine on either side; scutellum slender, arcuate in front, spined on either side. Legs slender. Wings thrice as long as broad, slender and rounded to tips, delicately shagreened, a black spot at the apex of each nervure, and three black spots near apex; primary stalk short; stalk of subcosta short, subcostal nervure forming no stigma; radius straight, turning up, just above tip of wing; stalk of cubitus very long, upper branch of cubitus long and straight, upper and lower forks of about equal length, turning downward at tips; lower branch of cubitus turning down, upper fork long, curving round, lower fork short; clavus long, straight. Abdomen short, broad. Genitalia: (♂) very large, turned up over the back, lower genital plate rounded beneath; forceps slender, long, curved inwards; penis small; upper genital plate very long, broad at base, curved and tapering to tip: (♀) formed of two slender plates enclosing the ovipositor, nearly as long as the rest of abdomen.

Hab.—Termiel, N.S.W., (on *Syncarpia laurifolia:* W. W. Froggatt).

This is a rare species which I have only met with on one occasion on the South Coast. Insects in all stages of growth cluster upon the tips of the young shoots of the Turpentine Gum, enveloped in a fine white flocculent down.

Genus BRACHYPSYLLA, n.g.

Head narrow, deflexed in front, face long. Face lobes short, broad, rounded at apex. Antennæ very short, apical joints very short. Eyes very large, reniform. Thorax: pronotum large. Wings very broad and rounded at tips; stalk of subcosta very long; subcostal nervure running directly into costal nervure, forming no stigma or thickening of costa; radius curving upward at tip; stalk of cubitus short, upper branch of cubitus long, straight. Legs long, slender, with a number of spines at apex of hind tibiæ.

Type *Brachypsylla tryoni.*

BRACHYPSYLLA TRYONI, n.sp.

(Plates xv., fig. 1; xvi., fig. 1.)

Larva bright yellow, eyes bright red. General form elongate, antennæ and legs stout, long. Head rounded in front. Thorax small. Abdomen short, constricted at base, swelling out on sides to rounded apex, heart-shaped. Dorsal surface fringed and covered with scattered short hairs which are again covered with fine particles of white sugary secretion, and a drop of liquid or filament on the anus.

Pupa light yellow, shaded with olive-green, thickly mottled with brown on dorsal surface; tips of antennæ, tarsi, eyes, two large blotches between them, four more angular patches, and several pencil-like lines on thorax, wing-covers, five interrupted bands on upper segments and apical portion of abdomen dull brown. General form short, broad, with tip of body turned up when crawling on foliage. Head irregularly rounded in front and on sides, truncate behind, broader than long, antennæ stout, pointed at tips, standing out on sides of head; eyes angular on inner margins. Thorax short, nearly square, longer than broad; wing-covers very large; legs rather long. Abdomen large, nearly hemispherical, slightly arcuate at tip. Ventral surface showing a ring of brown spots.

Imago.—Length 0·05, antennæ 0·0075 inch.

General colour black, dorsal surface mottled with minute grey scales giving it a clouded appearance; legs clothed with fine grey hairs; 2nd, 3rd, and basal half of 5th antennal joint, tibiæ, and tarsi ochreous; eyes reddish-brown; wings semitransparent, but so thickly blotched with dark brown that there is very little of the lighter colour; nervures fuscous, light-coloured where crossing white blotches in wing. Head small, deeply arcuate behind, turned down in front, distinctly rounded, flattened, with a slight ian suture. Face lobes short, broad at base, rounded at apex. nnæ very short, springing up in front of eyes; 1st joint stout; 2nd cylindrical, short; 3rd longest; 4th-5th long; very short, rounded; 10th shortest. Eyes very large, ting, reniform viewed from above: central ocellus small, to base of face lobes; lateral ocelli small, close to upper of eyes. Thorax: pronotum rather large, uniform in width, ; to hind margin of eyes, with an impressed spot on either dorsulum nearly truncate in front, rounded behind; meso- n broad, convex, deeply arcuate in front, rounded at mities; scutellum small. Legs long, slender, hairy, spines on apex of hind tibiæ numerous. Wings more than twice as long as broad, narrow at base, broadly rounded at tip; primary stalk stout; stalk of subcosta very long; subcosta acute, running into costal, forming no cell or stigma; radius short, parallel, turning up slightly at tip; stalk of cubitus short, upper branch of cubitus long, straight, upper fork curving downward, lower fork nearly as long as upper, lower branch rather long, upper fork arched, curving round in a half circle, lower fork turning inwards; clavus stout, clavical suture slender. Abdomen short, stout. Genitalia: (♂) lower genital plate short, rounded; forceps short; upper genital plate large, broad at base, coming out into a horn-like point at apex: (♀) short, upper and lower valves coming to a point, slightly turned up at tip.

Hab.—Brisbane, Queensland (on *Conyza viscidula:* H. Tryon).

The eggs are scattered about among the hairs on the underside of the leaves of this plant, of a deep yellow colour, and more pointed than usual. I have a very fine series of this curious and very distinct species from Mr. Tryon, who says "it is rather common in the neighbourhood of Brisbane."

iv. Subfamily TRIOZINÆ, F. Loew.

Front of head either swollen or produced into two conical processes; eyes more or less prominent. Stalk of cubitus wanting; vein forking directly from junction with subcosta.

Genus i.—**PETALOLYMA**, Scott, Trans. Ent. Soc. Lond. 1882, p. 459.

ii.—**BACTERICERA**, Puton, Ann. Soc. Ent. France, (5), vi., 1876, p. 286.

iii.—**TRICHOPSYLLA**, Thompson, Opus. Ent. 1877 (f. viii.), p. 820.

iv.—**TRIOZA**, Förster.

v.—**RHINOPSYLLA**, Riley, Proc. Biol. Soc. Washington, 1888, p. 71.

vi.—**PACHYPSYLLA**, Riley, *l.c.*

vii.—**NEOLITHUS**, Scott, *l.c.*, p. 445.

viii.—**PHACOPTERON**, Buckton, Ind. Mus. Notes, Vol. iii., No. v., p. 18, 1895.

ix.—**PARHYPSYLLA**, Riley, Canadian Entomologist, xv., p. 157, 1883.

x.—**CEROPSYLLA**, Riley, Proc. Biol. Soc. Washington, 1888.

Genus TRIOZA, Förster.

Head produced into two conical processes in front. Eyes large: ocelli large. Antennæ slender from 3rd joint to apex. Wings: cubitus without a stalk; hind marginal nervure producing three branches, of which two spring from the same point; three short nervelets free on the dorsal edge of wing between the fork of cubitus.

Most of the Australian species in this subfamily appear to fit very well into the Genus *Trioza*. The larvæ of a number being gall-makers, spend the earlier stages of their existence enclosed in thick fleshy galls upon the foliage of different species of Eucalypts. I do not know of any psyllid galls on other trees than Eucalypts. Upon *Tristania* and *Eugenia* the insects form curious pits and blisters and not true galls, in which the larvæ remain until full grown in their natural state, though firmly imbedded; if the leaves are gathered too early, when they commence to dry the larvæ disconnect themselves from the leaves and crawl about quite easily.

The extraordinary form of the fish-like larvæ of the species living upon the Casuarina, shows how they adapt themselves to the slender thread-like foliage upon which they live. Scott has described several South American species producing galls, and Buckton recently described one from India, and though he figures the wings as those of a *Trioza*, he places it in the genus *Psylla*.

TRIOZA ORBICULATA, n.sp.

(Plates xv., fig. 9; xvi., fig. 22.)

Pupa large, broad; dorsal surface black, fringed right round with fine ciliated spines; ventral surface pale green, legs and antennæ black. Back flattened; head and thorax forming a rounded shield twice as large as abdomen.

Imago.—Length 0·11, antennæ 0·03 inch.

General colour brownish-yellow; eyes reddish-brown; abdominal segments darker, banded with fuscous; wings hyaline, nervures light brown. Head narrow, nearly as broad as the thorax, deeply impressed in front, with a deep median suture, and large fovea on either side wrinkling up all the front of the forehead; hind margin deeply arcuate. Face lobes small, fringed with long hairs. Antennæ very long, slender; 1st-2nd stout; 3rd-9th long, slender; 10th short, slightly clubbed. Eyes large, projecting, rounded on outer margin, deeply angled on inner margin: central ocellus hidden at apex of median suture; lateral ocelli large, in line with centre of eyes. Thorax: pronotum very narrow, curved upward, swelling out behind eyes; dorsulum very large, convex, projecting and rounded in front, sloping sharply on sides, which are rugose and slightly toothed, apex truncate; mesonotum large, curving round dorsulum on sides, truncate in centre, at base and apex; scutellum large, truncate in front, convex, rounded behind. Legs short, stout. Wings nearly thrice as long as broad; long, slender, more rounded at tips than usual; primary stalk long, turning slightly upward; stalk of subcosta very short, no costal cell or stigma; radius short, turning up, forming a lanceolate cell, stalk of cubitus wanting; upper branch of cubitus first turning upward then downward; upper fork rather straight, running out above tip of wing; lower fork shorter, turning downward; lower branch of cubitus turning straight down, upper fork forming a large rounded curve; lower fork straight, turning in at tip; clavus thickened. Abdomen short and stout. Genitalia: (♂) forceps large, rounded, and turning upward into a pear-shaped tip.

Hab.—Bungendore, N.S.W. (on *Eucalyptus* sp.; W. W. Froggatt).

Larva producing four or five broadly rounded fleshy galls from ¾ inch to 2 lines in diameter, and ½ inch in height upon the foliage of *Eucalyptus* sp. They are variable in form; the attachment to the leaf is slight, but the whole of the base of gall is flattened on the leaf, swelling out, rounded at apex, with from three to six tubular cells, each containing a larva. When immature these openings are very indistinct. The colour of the galls is variable, those exposed being brightly tinted with red and yellow; those hidden or sheltered of a pale sea-green colour, but all are clothed with a fine white plum-like bloom.

TRIOZA CARNOSA, n.sp.

(Plate xvi., figs. 12 and 24.)

Larva dark brown on dorsal surface, green shaded with yellow on thorax and on ventral surface; eyes red; antennæ and legs light brown. Outer margin of dorsal surface fringed with minute ciliated spines, covered with white woolly filaments which rub off very easily. Head small, imbedded in thorax but outlined with a light yellow line and suture of same colour down the centre of the back; antennæ very short, horn-shaped; eyes very small. Thorax and head combined forming a rounded shield; tips of wing-covers overlapping base of abdomen; legs short, thick. Abdomen arcuate on sides, rounded to apex. Ventral surface rounded, abdomen showing segmental divisions, with a regular upper edge or flange right round.

Pupa similar in form and colouration to larva, with the wing-covers much more prominent, and the outer margins more thickly fringed with white filaments.

Imago.—Length 0·1175, antennæ 0·03 inch.

General colour reddish-yellow, dark ochreous marks on head and thorax, abdomen yellow tinged with green and barred with brown to blackish bands; tips of antennæ black; eyes reddish-brown; wings hyaline, nervures reddish-brown Head small, deeply cleft in centre, and wrinkled on either side of median suture; arcuate in front, rounded on sides, deeply arcuate behind. Face lobes large, rounded at tips, clothed with long hairs. Antennæ long, slender; 1st joint broad, short; 2nd short, bead-shaped; 3rd slender, very long; 4th-8th uniform, about half the length of 3rd; 9th shorter; 10th short, thickened, and rounded at tip. Eyes very large, projecting, angulated on inner margins: central ocellus large at base of central cleft; lateral ocelli vitreous at angle of inner margin of eyes. Thorax: pronotum very narrow, deeply curved round in front, arcuate behind; dorsulum convex, almost round; with a slight spine on either side; mesonotum large, deeply arcuate in front, curving round dorsulum, rounded behind; scutellum truncate in front, rounded behind; legs long, slender. Wings more than twice as long as broad, narrow at base, broadest and rounded to tip; primary stalk long, straight; stalk of subcosta short; radius short, marginal cell long, nearly reaching to tip of wing; upper branch of cubitus turning downward, long, upper and lower forks short, the former emerging above tip of wing; lower branch of cubitus short, turning sharply down, upper fork long, curving round; lower fork rather long, transverse, curving in at extreme tip; clavus short, curved; clavical suture slender: centre of cells on hind margin with fine striæ. Abdomen stout, tapering to apex. Genitalia: (♂) very short, lower genital plate short; forceps short, peg-shaped; upper genital plate broad, curving over forceps: (♀) fitting into tip of abdomen, hidden from above, formed of two slender serrate valves.

Hab.—Sydney, Mittagong, &c., N.S.W. (on *Eucalyptus* sp.; W. W. Froggatt): New Norfolk, Tasmania (on *E. obliqua*: A. M. Lea).

The larvæ produce thick fleshy soft galls of a regular oval form upon the leaves of several species of Eucalypts, measuring up to 8 lines in height and 5 in diameter at the centre, narrow and constricted at the base, brightly tinted with green and red when occurring in exposed positions; sometimes single, but generally in groups of two or three in contact with each other. The larva attacks the leaf from the undersurface, but unlike the "bubble galls," the scar heals up, and as the gall increases in size it cracks at the apex, forming an irregular slit opening into a tubular chamber, in the centre of which is to be found the larva attached by its rostrum to the bottom of the chamber, but easily detached. When full grown the psyllid casts its pupal skin and emerges through the top of the gall.

This is a widely distributed species, forming galls on several of the thick-leaved Eucalypts, but about Sydney chiefly upon *E. capitellata.* The insects are very variable in colour and size, the females being much bigger than the males. I have placed specimens received from Tasmania with our own specimens, as the galls are exactly alike and the general structure seems to agree, though the perfect insect is much larger.

TRIOZA EUCALYPTI, n.sp.

(Plate xvi., fig. 23.)

Larva.—General colour ochreous on dorsal surface floured with white dust which forms white filaments round the outer edge beneath which is an unbroken fringe of short spiny hairs; eyes dark reddish-brown; ventral surface covered with floury secretion; head, thorax and legs ochreous; abdomen pale green. General form flattened and shield-shaped above. Antennæ short, thickened at base, curling round like a sheep's horn; legs stout, thick, with large tarsal claws; ventral surface swelling out, corrugated; abdomen convex and globose. (When the larva is removed from the gall it turns the abdomen up when crawling).

Pupa not differing from full-grown larva.

Imago.—Length 0·115, antennæ 0·04 inch.

Light reddish-brown, central segments of antennæ and base of abdomen fuscous; eyes dark reddish-brown; tarsi black; wings hyaline, iridescent, nervures ochreous. Head small, deeply cleft in front, forming a rounded lobe on either side with deep impression in centre, arcuate at base of antennæ, arcuate behind, swelling out behind eyes. Face lobes short, rounded, hidden from above. Antennæ long, slender, springing from centre of head lobes in front of eyes; 1st-2nd joints very short; 3rd very long and slender; 4th-8th much shorter, slender, uniform in length; 9th-10th very short, the latter thickened, and truncate at tip. Eyes large, rounded, prominent, slightly angular on inner margin: central ocellus at apex of cleft; lateral ocelli in line with angle of eyes. Thorax: pronotum very small, deeply convex in front, swelling out at tips behind eyes; dorsulum short, nearly circular, convex, produced into a spine at extremities; mesonotum very large, broad, arcuate in front, rounded to sides, where it is produced into an angular point, truncate behind; scutellum small, arcuate in front, rounded behind. Legs long, lightly clothed with long hairs; femora short, thickened; tarsal claws large. Wings nearly thrice as long as broad, rounded to tip; primary stalk very long, straight; stalk of subcosta very short; radius short, curving downward; upper branch of cubitus long, curving downward; upper fork longest, emerging above tip of wing, lower fork shortest; lower branch of cubitus very short, curving down, upper fork long, curving round, lower fork running straight down; clavus short, stout; clavical suture short: striæ marking the cells on hind margin of wing. Abdomen large, rounded to tip. Genitalia: (♂) short, very similar to former species: (♀) more elongate, but formed of two similar toothed valves contracted beneath the tip of abdomen.

Hab.—Mosman, near Sydney, N.S.W. (on *Eucalyptus Sieberiana*; W. W. Froggatt).

The larvæ produce thick, solid, rounded galls, four lines in diameter, flattened on the apex, sometimes scattered singly upon the leaves, but frequently clustering together so that several when numerous the foliage of the infested tree becomes aborted and curled up from the immense number of woody galls. The insect attacks the leaf from the underside, leaving a ragged scar at place of entry; the galls grow out on the other side, of a dull yellow colour with a rounded mark on summit; the chamber small, circular, just large enough to contain the larva. The galls as they dry crack at the apex into four or five segments, curling outward in a very peculiar manner after the psyllids have abandoned them. I have cut the perfect psyllid out of perfectly closed galls in which there was no opening, so that I do not understand how the perfect insect makes its way out of the gall; probably most of them are ready to come forth just as the apex of the gall splits.

This species is closely allied to *Trioza multitudinea*, Tepper, described by Maskell from South Australia, but his description of the galls and insects does not apply to this one, which is probably a local species.

TRIOZA CIRCULARIS, n.sp.

Larva similar in colour and form to that of the preceding species. Dorsal surface flattened, thickly fringed on outer margin with fine ciliated spines, hidden beneath an upper fringe of white waxy secretion.

Imago.—Length 0·1, antennæ 0·035 inch.

General colour ochreous with yellow tints; abdominal segments banded with dark brown; antennæ yellow, apex of 4th-7th and the whole of 8th-10th joints fuscous; wings hyaline, nervures light brown. Head short, deeply divided in front, flattened, rugose, with median suture and fovea on either side: rounded in front to eyes, arcuate behind. Face lobes short, broad, rounded. Antennæ long, slender; 1st and 2nd joints short, stout; 3rd very long, cylindrical, thrice as long as broad; 4th-7th of uniform length; 8th shorter; 9th-10 very short, truncate at apex. Eyes very large, not as long as head, angular on sides: central ocellus well up in centre of median suture; lateral ocelli large, on summit of head. Thorax: pronotum very narrow, rounded in front, arcuate behind; dorsulum very large, prominent, convex, rounded and narrow in front, swelling out and rounded behind; mesonotum large, broad, slightly depressed in front, with a faint median suture, arcuate in front, rounded on sides, truncate at apex; scutellum large, flattened, rounded behind. Legs short, stout; tibiæ long, tarsi and claws large. Wings more than twice as long as broad, rounded from front margin to tip, which is slightly acute; primary stalk long, straight; stalk of subcosta short; radius short, not reaching to tip of wing; upper branch of cubitus curving downward, upper fork emerging just above tip of wing, lower fork shorter, forming an angular cell; lower branch of cubitus turning downward, upper fork rounded, lower fork curving in at tip; clavus stout, clavical suture long, slender. Abdomen large, rounded at tip. Genitalia: (♀) very short, rounded and hidden under tip of abdomen.

Hab.—Wyong, N.S.W. (on *Eucalyptus* sp.; W. W. Froggatt).

This is not a common species. The larvæ produce much more regularly formed spherical galls than is usual, measuring from three to four lines in diameter, clustered together in such numbers as to frequently abort the leaves. The opening is on the under side of the leaf, with the walls of the gall very thick and fleshy.

TRIOZA MULTITUDINEA, Tepper.

Maskell, Trans. R. Soc. S. Aust. 1898, p. 8, pl. iii., figs. 11-17; *Ascelis* (?) *multitudinea*, Tepper, *op. cit.*, Vol. xvii. p. 278, 1893, pl. iii, figs. 15-21.

Mr. Maskell redescribed this species, originally described by Mr. Tepper in a paper entitled "South Australian Brachyscelid Galls," in which he placed it among the gall-making coccids. He sent some of these supposed coccid galls to Maskell, who found that they contained the larvæ of a psyllid from which he bred some of the perfect insects. Among others he says that Mr. Froggatt sent him specimens of the galls from New South Wales. But I doubt if he bred any specimens from the galls that I sent, find no examples of the species in my collection which agree with the description of *T. multitudinea.*

He says the "adult female is almost entirely yellow, with a darker tinge on the thorax, dorsally, and at the extremities of the antennæ and feet; the eyes are red, semiglobular, faceted, placed on a short tubercular base. The head is broader than long, depressed in front and produced beneath in two moderately long sub-conical processes: the rostrum is cylindro-conical. The antennæ have 10 joints, all elongated, subequal and ringed, except first two, which are short and smooth." The genitalia are remarkable, and the wings more elongated and pointed than in most species.

Hab.—Marino, S.A. (on *Eucalyptus* sp.; J. G. O. Tepper).

TRIOZA BANKSIÆ, n.sp.

(Plates xv., fig. 4; xvi., fig. 26.)

Pupa pale greenish-yellow; eyes black; dorsal surface covered with fine silvery tinted hairs. General form oval, flattened on dorsal surface; head and thorax rounded in front and on sides; antennæ short, apical joint longest; wing-covers small, projecting slightly at apex; abdomen slightly constricted at base, rounded to apex, fringed right round with ciliated spines; ventral surface flattened; legs stout.

Imago.—Length 0·0375, antennæ 0·0075 inch.

General colour pale golden-yellow; eyes brown; wings hyaline, nervures light brown. Head large, deeply cleft in front, rounded on sides, arcuate behind. Face lobes large. Antennæ short, slender; 1st joint short, stout; 2nd twice the length of 1st; 3rd slender, thrice the length of 2nd; 4th half length of latter; 5th shortest; 6th-8th of uniform length; 9th-10th much shorter, slightly swollen to tip. Eyes large, rounded on outer margins, angulated on inner: central ocellus small, lateral ocelli close to eyes. Thorax: prothorax narrow; dorsulum large, convex, irregularly rounded; mesonotum large; scutellum large, rounded. Legs slender. Wings thrice as long as broad, rounded to an angular tip; primary stalk long; stalk of subcosta medium, costal cell wanting; radius short, turning upward, upper branch of cubitus long, upper fork short, running out above tip of wing; lower fork shortest, turning downward; lower branch of cubitus transverse; upper fork short, arched; lower fork very short, curving in at apex. Abdomen short. [Genitalia damaged.]

Hab.—Botany, near Sydney, N.S.W. (on *Banksia serrata;* W. W. Froggatt).

This is a very rare species which does not form galls. The larvæ cling close to the undersurface of the leaves of the food-plant which they very closely resemble in colour, but produce no gall or blister. The perfect insect when at rest has the body and wings pointed upward as if it were standing on its head.

TRIOZA EUGENIÆ, n.sp.

(Plates xv., fig. 10; xvi., fig. 15.)

Larva varying from pale to dark yellow, eyes pink. General form oval; dorsal surface flattened, shield-shaped, outer margin with a rim of lace-like fringe quite different from the encircling ciliated spines in other species of this genus; ventral surface convex, margined with a fleshy flange. Antennæ 8-jointed, broad at base, coming to a point at tip, reaching edge of marginal flange. Legs short, stout. Abdomen much corrugated.

Pupa varying in colour from dark yellow to brown. More circular in form than the larva; head showing a rounded base and apex through dorsal shield; eyes large; antennæ extending beyond edge of shield; wing-covers slightly swollen on sides, overlapping the basal segment of abdomen; a broad transverse suture between thorax and abdomen.

Imago. Length 0·0675, antennæ 0·01 inch.

Colour very variable, in freshly emerged specimens from dull yellow to ochreous; eyes reddish-brown, last two apical joints of antennæ black; thorax marbled with yellow lines; wings hyaline, nervures light brown. The whole insect clothed with fine hairs, thickest and longest on front of head, back and abdomen. Head short, not as broad as thorax, slightly truncated in front, with a fine median suture; a small fovea on either side, and a slight transverse ridge above; arcuate behind. Face lobes large, conical, hirsute. Antennæ long; 1st-2nd joints stout, broad; 3rd very long, slender; 4th-8th about half the length of 3rd; 9th-10th much shorter, swollen, forming a slight club. Eyes very large, projecting, rounded on outer edge, truncate on inner: central ocellus small, at apex of median suture; lateral ocelli small, close to upper margin of eyes. Thorax: pronotum short, broad, rounded in front, arcuate behind; dorsulum large, hexagonal, with sides slightly tuberculate; mesonotum large, slightly arcuate in front, truncate behind, with sides sloping upward; scutellum very large, arcuate in front, rounded behind. Legs long, slender, clothed with fine hairs; apex of tibiæ of fore-legs with a stout spine on either side of the large tarsal joints. Wings large, more than twice as long as broad, front margin curved, apex forming an angular tip; primary stalk long, straight; stalk of subcosta long; radius short, forming a lanceolate cell; upper branch of cubitus long, curving downward; upper fork short, emerging above tip of wing; lower fork shorter, emerging below tip of wing; lower branch of cubitus long, sloping down; upper fork short, curving round; lower fork short, curving in at tip; clavus slender, clavical suture slender. Three wedge-shaped marks of false striæ on hind margin. Abdomen short, broad. Genitalia: (♂) lower genital plate short, broad; forceps short, broad at base, conical but dilated at apex; upper genital plate short, broad, rounded above: (♀) short, conical at tip.

Hab.—All the coastal districts of New South Wales (on *Eugenia Smithii;* W. W. Froggatt); Gippsland, Vic. (on *E. Smithii;* C. French, Junr.).

The larvæ attach themselves to the young foliage of the tree, commencing on the upper surface of the leaves (sometimes as many as 50 upon a single leaf); puncturing them with their sharp rostra, they cause small blisters to appear on the undersurface so that the insects lie in the hollow thus formed, with the dorsal surface level with the upper surface of the leaf. When immature the outer margin of the shield-shaped larva is smooth, but in the later stages of development there is a regular marginal fringe of white waxy filaments round the pupa.

This species has a wide range, probably as wide as the food-plant, as I have them from the Northern Rivers (Lismore) to Gippsland in the south. When badly infested the foliage of the food-plant becomes much discoloured, tinted with reds and yellows, and twisted, corrugated and aborted. Though the insects seem to be firmly attached to the leaves, when they were kept in jars for observation they detached themselves and crawled about as soon as the foliage began to wither.

I have a series of specimens obtained on some undetermined shrub (probably *E. Smithii*) at Clifton some years ago, in which the cross-nervures between the primary stalk and the costal nervure are clouded with black, and the clavus is blotched, markings which I have never found on the typical form. This, however, may be a distinct species, but in the absence of more fresh material, I regard it as a seasonal variety of the typical form.

TRIOZA CASUARINÆ, n.sp.

(Plates xv., fig. 11; xvi., fig. 27.)

Pupa dark ochreous to darker brown. General form long, slender, thrice as long as broad; dorsal surface convex; head rounded in front to behind eyes, showing a fine median suture running back to base of abdomen. There is no distinct division between head and thorax. Eyes large, projecting; antennæ represented by two small pointed horns between eyes. Thorax constricted behind head, swelling out again and sloping round to base of abdomen; wing-covers not showing, legs hidden from above; abdominal segments tapering slightly to a rounded tip, divisions distinct; ventral surface flattened, showing a fine median suture, and small legs. Front of head fringed with fine hairs; the outer margin forming a slender flange which encircles the whole insect.

Imago.—Length 0·0625, antennæ 0·015 inch.

General colour dark brown to ochreous, marked with yellow, eyes reddish-brown, basal joints of antennæ brown, apical ones black; wings hyaline, nervures light brown, all the inner ones broadly marked with dark brown. Head broad, deeply cleft in front, sides sloping round to eyes, deeply arcuate at base. Face lobes large, conical, turning downward. Antennæ short; 1st-2nd joints short, broad; 3rd very long, slender; 4th-9th short, uniform; 10th short, slightly thickened, truncated at tip. Eyes very large, rounded, projecting: central ocellus very small, at apex of cleft; lateral ocelli vitreous, close to hind margin of eye. Thorax: prothorax angulated in front, short, deeply arcuate behind; dorsulum rounded in front, truncate behind, rounded on sides; mesothorax broad, of uniform width to wings; scutellum truncate in front, rounded behind. Legs rather long, slender, thighs stout, tarsi large. Wings slightly more than twice as long as broad, rounded on both sides, terminating in a rounded tip; primary stalk long, parallel; stalk of subcosta rather long, sloping upward, no costal cell or stigma, cross nervure running straight into costal nervure; radius very short, turning up into costal nervure; no cubital stalk; upper branch of cubitus long, arched, turning downward; upper fork very short, turning upward, emerging above the tip of wing; lower fork shorter, turning down below the tip; lower branch of cubitus long, upper fork short, arched; lower fork very short, running straight down into margin of wing; clavus very long and stout, clavical suture very slight. Abdomen short, coming to a rounded tip. Genitalia: (♂) very short, broad, and turned up over the back; lower genital plate very large, broad, round; forceps large, peg-shaped; upper genital plate peg-shaped, turned backward.

Hab.—Manly, near Sydney, N.S.W. (on *Casuarina distyla;* W. W. Froggatt).

This is a very remarkable species, the larval and pupal forms being quite different from any other known to me, their slender, elongate forms being admirably adapted for clinging to the slender foliage of the she-oak.

v. Subfamily PRIONOCNEMINÆ, Scott.

Head small, crown measured down the centre more or less than one-half the width between eyes. Face lobes short (wanting ?); antennæ long, slender. Eyes large. Thorax: pronotum narrow, broadest in middle, as long as outer edge of eyes; mesonotum convex, widest at insertion of elytra. Wings elongate, more or less acute at apex, with a stigma (?); cubitus petiole short, dorsal margin with two or four nervelets. Legs: tibiæ of 3rd pair with stout, curved, angular tooth at base, apex dilated, with a more or less serrate margin.

Genus i.—CARSIDARA, Walk. } Journ. Linn. Soc. Zool., Vol. x.,
,, ii.—TYORA ,, } pp. 329-330.

In the two following species I have found so many affinities to the genus *Tyora* that I refrain from forming a new genus for their reception, and so I have placed them in this. Walker formed the genus on one specimen (minus the head) from Mysol; but in Scott's definition of the genus he says "head wanting," though in that of the subfamily containing the two genera he says "face lobes short, antennæ long, slender, eyes large." Walker, however, in his description, says "antennæ graciles, filiformes," but he does not note anything about the face lobes. Walker does not say whether there is a stigma in the forewing; and though Scott figures the wing of this species, with the remarkable cross nervure and no stigma exactly as my species, he says "stigma joined to radial by a transverse nerve."

Genus TYORA, Walker.

"Body slender, antennæ slender, filiform, much longer than the thorax; 1st and 2nd joints incrassated. Legs stout, rather short. Fore wings narrow, with three longitudinal veins, which are connected near the base; first vein emitting an oblique vein, and an exterior short directly transverse vein to the costa; second vein emitting three oblique veins to the hind border (of these secondary veins the first and second are connected by a transverse vein, third vein extending obliquely to the hind border)."

TYORA HIBISCI, n.sp.

(Plates xv., fig. 8; xvi., fig. 18.)

Larva semitransparent, abdomen pale yellow. General form shorter and broader than usual, lightly clothed with white filaments on dorsal surface. Crawling about on the underside of leaves among the fine hairs of the foliage.

Pupa green, richest towards abdomen; antennæ and legs semitransparent, tips of former and tarsi of latter fuscous, eyes reddish brown; front of head, wing-covers, thorax and basal joint of antennæ clouded with bright yellow. Head short, broad, deeply cleft in front, sloping on sides to eyes; antennæ very long and slender; eyes small, not projecting, arcuate behind. Thorax short; wing-covers very broad, swelling out on sides; legs very long, slender, tarsal joint long, slender, second joint terminating in two small curved claws, quite different from the digitales observed in other species in the pupal stage. Abdomen broad at base, rounded, longer than broad, covered with white filaments, that in some cases also cover the whole of the dorsal surface.

Imago.—Length 0·085, antennæ 0·04 inch.

General colour bright green, clouded with yellow on head and thorax; apex of 3rd-4th and base of 10th antennal joints, apex of tibiæ and tarsi black; eyes dark brown; four slender white parallel lines on dorsal surface of head; irregular white lines dotting the abdomen; wings hyaline, nervures ochreous, each blotched with a rounded spot where they cross or emerge on outer margin of wing. Head very short, broad, deeply cleft in front, each side forming a lobe from which the antennæ spring; median suture distinct, arcuate behind. Face lobes wanting. Antennæ very long, slender; 1st joint very short, broad; 2nd short, cylindrical; 3rd longest; 4th-7th of uniform length; 8th shorter; 9th short, slightly swollen at apex; 10th short, swollen at base, pointed at tip. Eyes very large, as broad as head : central ocellus large, at apex of median suture; lateral ocelli small, close to eyes. Thorax large, narrow to base of wings, swelling out behind; pronotum broad, rounded at apex; dorsulum very broad, rounded in front, coming to a point on either side; mesonotum large, arcuate in front, rounded to apex. Legs long, slender, a claw at apex of hind femora, last joint of tarsi long; apex of tibiæ of hind legs dilated, with marginal spines forming a group of three on inner margin and one on either side, a slight spine also at apex of first tarsal joint. Wings thrice as long as broad, curved round on costal margin to tip, sharply rounded at tip; primary stalk rather short, stout; stalk of subcosta very long, as long as radius, subcosta short, transverse; no stigma; radius very short, turning upward, with a transverse nervure crossing from centre to the junction of furcation of upper branch of cubitus; stalk of cubitus short, one-half length of stalk of subcosta; upper branch of cubitus long; upper fork long, curving upward then turning down below tip of wing, lower fork shorter; lower branch of cubitus short, upper fork curving round then out at tip, lower fork short, curving inwards; clavus long, clavical suture slender: granulated spots on lower margin of wings, in centre of first cubital cell, and between it and second. Abdomen stout, tapering to extremity. Genitalia: (♂) lower genital plate broad, rounded; forceps slender, elbowed at base, curved in and pointed at apex; penis long, slender; upper genital plate stout, curving over forceps, with a keyhole-like notch on inner edge fringed with fine hairs: (♀) upper and lower genital plates short, slightly curved at tips.

Hab.—Brisbane, Q. (on *Hibiscus tiliaceus*; H. Tryon).

The larvæ and pupæ of this species are so thickly enveloped in white flocculent filaments that the undersurface of the leaves of the infested bush becomes quite sticky and smothered with their exudations. Mr. Tryon informs me the insects are very plentiful upon this plant all round Brisbane.

This is one of the most remarkable species that I have studied; related in the form and structure of head and legs to the species on the Kurrajong, which it also resembles in habits and earlier stages of its life history; but the venation of the wings is very distinct. The want of any costal cell or stigma, short radius, and remarkable transverse cross nervures between the centre of radius to furcation of cubitus place it quite alone.

TYORA STERCULIÆ, n.sp.

(Plates xv., fig. 5; xvi., fig. 10.)

Larva semitransparent; eyes, centre of thorax and abdomen red. General form elongate, uniform in width from sides of head to rounded tip of abdomen. Head slightly lobed in front, with a distinct median stripe; antennæ standing out straight on either side of head, thick at base, tapering to tips. Abdominal segments very distinct; apex clothed with a tuft of white filaments.

Pupa dull olive-green, thighs and inner margins of wing-covers light green; legs light brown, apex of tibiæ and tarsi black; wing-covers, head, spots on thorax and tip of abdomen brown; a dorsal stripe of red running from centre of head to tip of abdomen. Head broad, truncate between antennæ, rounded to eyes, swelling out and truncate behind; antennæ very long, slender, apex of each joint black; eyes large, projecting, rounded on outer and angled on inner margins. Thorax broader than head; wing-covers short, elongate-oval; legs stout, long. Abdomen swelling out at base, broadest across centre, slightly arcuate on sides near apex; tip of abdomen ornamented with a number of thick woolly filaments from two to five in number trailing out on sides and base to ¼ inch in length.

Imago. –Length 0·07, antennæ 0·0425 inch.

General colour bright green, ocelli yellow, eyes red, antennæ and tarsi brown; head, thorax and abdominal segments marked with black, wings hyaline, nervures dark brown. Head small, deeply cleft in front, rounded behind. Face lobes wanting. Antennæ projecting from rounded tubercle on either side of a median cleft, very long, slender; 1st joint broad at base; 2nd more slender at base, rounded at apex; 3rd longest; 4th-8th shorter; 9th shortest; 10th slightly thickened, short, rounded at tip. Eyes large, rounded on outer and angled on inner margin: central ocellus small, at base of median cleft; lateral ocelli elongate, on centre of inner margin of eyes. Thorax: pronotum lobed in front, rounded, projecting over base of head, sloping away on sides, hind margin deeply arcuate in centre, swelling out and pointed on sides; dorsulum convex, broad, rounded on both sides, elongate on outer margins; mesonotum large, arcuate both in front and behind, rounded on sides; scutellum convex rounded behind, fitting close into mesonotum. Legs long, slender, a short black curved spine at apex of femora; 1st tarsal joint long, with spines on inner edge; 2nd long, slender. Wings long, slender, more than twice as long as broad, rounded on costal margin, pointed at apex; primary stalk short; stalk of subcosta very long; subcosta turning up, then running parallel with costa, and again turning into costa, forming a narrow tail to the median cell, no transverse nervure or stigma; radius short, parallel, then turning sharply upward and coming out on upper margin of wing; stalk of cubitus very long, longer than that of subcosta, upper branch of cubitus almost straight (a little longer than stalk), upper fork long, curving round and emerging just below tip of wing, lower fork shorter, lower branch of cubitus short, upper fork curving round, lower fork curving in; clavus long, clavical suture slight: an irregular spotted or granulated mark on hind margin of wing in centre of first cubital cell, and another between it and second cubital cell. Abdomen constricted at base, slender. Genitalia: (♂) slender, lower genital plate broad, rounded on lower edge; forceps forming two slender curved processes turned inwards; penis slender; upper genital plate broad, conical, curved, truncate at tip: (♀) slender, pointed at tip.

Hab.—Forbes, N.S.W. (on *Brachychiton populneum*: W. W. Froggatt) Brisbane, Q. (on *Brachychiton* sp.; H. Tryon)

This is one of the most anomalous species I have found; and the living psyllid with its bright green tints, delicate transparent wings, and long slender legs and antennæ might easily be passed over at first sight as an aphis. The deeply cleft head, absence of face lobes, and the peculiar venation of the wings render it a very distinctive insect. The eggs are horn-colour, elongate-oval in form, and deposited in patches containing from 30-40 in number on the upper surface of leaves. The larvæ and pupæ cluster trailing out all round giving them a star-like appearance, and each family makes a large white blotch on the foliage. This species will probably be found in all localities where its food-plant is a native, and may also infest other species, as Mr. Tryon recently sent it to me from Brisbane.

SUPPLEMENT.

In the following pages are described several additional species belonging to the subfamily *Aphalarinæ,* which have been obtained or determined since the first portion of this paper was published. I hope to be able to add a considerable number to the already large list of Australian *Psyllidæ,* as I still have the earlier stages of a number of species worked out, but am waiting for more material to enable me to describe the perfect insects.

APHALARA FUSCIPENNIS, n.sp.

(Plate xiv., fig. 10.)

Larva bright orange-yellow, eyes red, tips of antennæ black. Head truncate in front, sloping round to eyes, truncate behind; nearly twice as long as thorax; antennæ stout, standing out on either side; eyes small, set far back in head; thorax very short; legs stout; abdomen constricted at base, rounded on sides, elongate. Front of head and legs clothed with a number of fine hairs, with much longer ones fringing the apical segments of abdomen, from which project a number of long white filaments.

Pupa light brownish-yellow; antennæ and legs fuscous, the tips of both black; two club-shaped blotches on head, wing-covers, two fine spots on sides and eight in centre of thorax, four slender marks on basal and the whole of the apical segments of abdomen dark brown. Head broad, rounded, truncate at base; antennæ short; eyes large, elongate, slightly projecting; thorax almost angular, wing-covers long, rounded at tips; legs long, stout; abdomen large, constricted at base, swelling out, rounded on sides, anal segment arcuate at tip, with numerous long filaments forming quite a tail behind.

Imago.—Length 0·05, antennæ 0·0125 inch.

General colour pale yellow to light green, marked with brown, tips of antennæ and eyes black; wings hyaline, with tip of marginal and submarginal cells clouded with brown, nervures light brown. Head long, broad, turning downwards in front, a deep median suture with fovea on either side; arcuate behind. Face lobes short, broadly rounded, hirsute. Antennæ springing out in front of eyes, short, slender; 1st and 2nd joints short, broad; 3rd very long, cylindrical, as long as next four combined; 4th-8th uniform; 9th-10th forming a slender club rounded to apex. Eyes large, hemispherical: central ocellus small, at apex of median suture; lateral ocelli close to hind margin of eyes. Thorax: pronotum convex in front, sloping down on sides; dorsulum narrow, truncate in front, rounded behind and tapering to a spindle-shaped point on sides; mesonotum large, arcuate in front, rounded behind; scutellum large Legs rather long; femora stout; tibiæ long, broad at apex, and lightly clothed with hairs. Wings thrice as long as broad, slightly rounded in front to tip; costal and inner nervures lightly fringed with fine hairs; primary stalk short; stalk of subcosta long, subcosta long, running close to costa, forming no stigma but a long slender tail to median cell; radius very long, curving downward to tip of wing; stalk of cubitus long, as long as stalk of subcosta, upper branch of cubitus long, curving slightly upward. upper and lower forks short, turning downward below tip of wing, both short and nearly of equal length; lower branch of cubitus long, upper fork rather long, rounded; lower fork very short, nearly transverse; clavus rounded, slender; clavical suture long, slender. Abdomen short, broad. Genitalia: (♂) short, broad; lower genital plate short, rounded; forceps short, slender, upper genital plate indistinct.

Hab.—Botanic Gardens, Sydney (on *Eucalyptus robusta*; W. W. Froggatt).

The larvæ cluster together in little families of as many as half-a-dozen upon the broad leaves, producing a patch of delicate white flocculent down in which they lie close to the surface of the leaf.

SPONDYLIASPIS GRANULATA, n.sp.

(Plate xvi., fig. 25.)

Lerp convex, longer than broad, opaque white to pale yellow, sides and ends sloping up to centre; 2 lines in length, 1 in width; attached on the sides to the upper surface of a leaf, with the ends open and a convex arch through which the larva can be seen. These lerp-scales are never plentiful, not more than one or two on a leaf, and resemble the lerp of *S. eucalypti* in general structure but are quite different in shape.

Larva differing very slightly from pupa, except in coloration; general colour dull yellow.

Pupa.—General colour pale yellow, abdomen pale green, antennæ and legs pale ochreous; two large blotches on head extending on to prothorax with two spots behind them; eight irregular spots on thorax and wing-covers light brown; a double row of impressed black spots down the centre and tip of abdomen black. Head short, slightly arcuate in front and behind; antennæ stout, thickened, curved round on sides, slightly pointed at apex; eyes very large. Thorax large; prothorax not as wide as eyes, sloping out to base of wing-covers; wing-covers narrow, pointed at apex; legs stout, tarsi slender at tips. Abdomen very broad, narrow at base, swelling out, rounded on sides to the tuberculate anal process.

Imago.—Length 0·065, antennæ 0·0325 inch.

General colour light green; face lobes, basal joints of antennæ and tarsi dull yellow; dorsal surface of thorax slightly tinged with yellow; legs and antennæ semitransparent, wings hyaline, nervures pale brown. The whole of the upper surface finely shagreened. Head wider than prothorax, slightly arcuate behind; deeply cleft and lobed in front, with a deep median suture and a shallow rounded fovea on either side; sides of face arcuate in front of eyes. Face lobes very long, opening out at base, curving round at tips, finger-shaped, rounded at tips, clothed with fine hairs. Antennæ and eyes as in *S. eucalypti.* Thorax: pronotum not as wide as head, rounded in front, arcuate behind inner margin of eyes, rounded on sides, deeply arcuate behind; dorsulum small, rounded in front; mesonotum broadly heart-shaped. Legs moderate, stout. Wings long, more than twice as long as broad, slightly angulated at tip, similar in structure to *S.* [illegible] except that the pterostigma is more slender and tapering, and the cubital petiole more like those of *S. mannifera*. Antennæ long, slender. Genitalia: (♀) forming a slender tapering point on last rounded abdominal segment.

Hab.—Botany, near Sydney, N.S.W. (on *Eucalyptus robusta*; W. W. Froggatt).

THEA OLIVACEA, n.sp.

(Plates xv., fig. 3; xvi., fig. 4.)

Larva semitransparent; eyes, dorsal suture from head to base of abdomen, transverse lines behind head, on thorax, and basal segments of abdomen red; central portion of head, thorax and base of abdomen tinted with yellow. Head as broad as thorax, deeply lobed in front, sloping on sides to front of eyes; antennæ 3-jointed, pointed at tips; eyes warty, apparently formed of several divided sections. Wing covers forming rounded knobs on sides. Abdomen [illegible] at base rounded and sloping behind to a [illegible].

[illegible] yellow; antennæ, [illegible] a double row of [illegible] first [illegible] dark [illegible] and ocelli red; dorsulum and mesonotum pale yellow, thickly mottled with light chestnut; wings semitransparent with an opaline tint, nervures light brown; abdomen red to reddish-brown, finely barred with black. Head short, broad, fitting very close against thorax, rounded in front, arcuate behind, without the usual frontal cleft but with a fine median suture without fovea. Face lobes short and rounded, hidden when viewed from above. Antennæ very slender, but short; 1st joint very short; 2nd more elongate, longer than usual; 3rd longest, slender at apex; 5th-8th shorter; 9th shorter; 10th shorter, truncate at tip. Eyes large, projecting, angular on inner margin: central ocelli at base of median suture; lateral ocelli large, not as close to the eyes as in most species. Thorax: pronotum narrow, rounded in front, extremities reaching to inner margin of eye; dorsulum small, rounded in front, arcuate on either side, forming a truncate tip, rounded behind; mesonotum large, arcuate in front, swelling out and rounded on both sides to scutellum. Legs stout, rather long. Wings thrice as long as broad, rounded in front, pointed at tips; primary stalk long, stalk of subcosta short; subcostal nervure forming a stout angulated stigma; radius long, turning slightly upward, running out at tip of wing; stalk of cubitus long, turning downward, upper branch of cubitus arching upward; upper fork longest, curving upward; lower fork a little shorter, turning downward; lower branch of cubitus short, slightly curved; upper fork sharply rounded, turning down; lower fork short, turning inward; clavus long, stout; clavical suture long. Abdomen short, stout. Genitalia: (♂) lower genital plate short, conical, forceps broad at base, tapering to tip; upper genital plate large, and longest: (♀) very large, long, and sabre-shaped, upper genital plate thickest, shorter, ribbed on sides; lower genital plate longest, finely toothed on upper edge, truncate at tip.

Hab.—Mittagong, N.S.W. (on *Eucalyptus capitellata;* W. W. Froggatt).

The larvæ and pupæ in all stages of growth cluster over the bark of the branches of the Eucalypt, enveloped in a white sticky secretion, which envelopes the whole of the insect, and appears to come from the dorsal surface of the abdominal segments. The small branches of infested trees are quite whitened.

CARDIASPIS TEXTRIX, n.sp.

(Plates xv., fig. 6; xvi., fig. 19.)

Lerp.—A delicate net-like basket attached to the leaves in the centre of a discoloured patch caused by the larva; 3½ lines in length, 4 in breadth, 2½ in height; constructed with a number of pale red, semitransparent, parallel ribs arching over in the form of a dome, rounded at the base and swelling out on the apical edges, recrossed with finer transverse threads of a similar colour, producing a fine net-like pattern.

Pupa dull yellow to pink; antennæ, large blotches on head, wing-covers, spots on thorax and abdomen black. Head short, broad, rounded; antennæ slender, standing out on side of head; eyes small, rounded. Thorax swelling out towards thorax, covered with impressed black spots; wing-covers very small, rounded at tips; legs short, stout. Abdomen large, globular, narrow at base, swelling out on sides and pointed at apex; segmental divisions very distinct.

Imago.—Length 0·0875, antennæ 0·0175 inch.

General colour varying from pink, marbled with greyish-brown to ochreous marbled with black; antennæ pink, apex of 3rd-9th and the whole of 10th joint black; face lobes bright red; head and thorax mottled with grey; lines between head and thorax, spot at base of wings, and broad transverse bands on abdomen black; wings transparent, nervures red. Head short, turning downward, not as broad as thorax, lobed in front, with a deep median suture and a slight fovea on either side; deeply arcuate behind. Face lobes very large, broad, rounded, clothed with fine hairs. Antennæ very short, slender; 1st-2nd joints short, broad; 3rd longest; 4th-8th uniform in length; 9th larger; 10th short, rounded at tip. Eyes very large, hemispherical: central ocellus at apex of median suture; lateral ocelli large. Thorax: pronotum wrinkled at extremities; dorsulum large, convex, rounded on either side, tips coming to a point; mesonotum very large, arcuate in front, rounded behind; scutellum unusually long, slender. Legs rather long, stout; femora stout, tarsi large. Wings nearly thrice as long as broad, sharply rounded in front, with thickened costal nervure at base, tip broad; primary stalk short, stalk of subcosta short; subcosta parallel, running into costa past centre of wing; radius short, coming out at upper edge of wing; stalk of cubitus long, upper branch of cubitus and upper fork running parallel with radius, turning upward at tip; lower fork of same length, turning downward at tip; lower branch of cubitus short, upper fork curving round, lower fork transverse; clavus short, stout; clavical suture very slender. Abdomen short, broad. Genitalia: (♂) short, turned upward; lower genital plate short, angular; forceps short, slender, curving upward; upper genital plate broad, truncate at tip: (♀) forming a short rounded point.

Hab.—Adelong, N.S.W. (on *Eucalyptus melliodora;* W. W. Froggatt).

This is a rare species, and certainly its lerp structure is one of the most beautiful. The enclosed pupa has plenty of room to move about in its regular little cage.

EXPLANATION OF PLATES.

Plate xiv.

Fig. 1.—*Psylla acaciæ-pendulæ*, n.sp.; wing.
Fig. 2.——— *acaciæ-baileyanæ*, n.sp.; wing.
Fig. 3.——— *schizoneuroides*, n.sp. ,,
Fig. 4.———*frenchi*, n.sp. ,,
Fig. 5.——— *acaciæ-pycnanthæ*, n.sp. ,,
Fig. 6.——— *capparis*, n.sp. ,,
Fig. 7.——— *acaciæ-decurrentis*, n.sp. ,,
Fig. 8.—*Eucalyptolyma erratica*, n.sp. ,,
Fig. 9.———— *maideni*, n.sp. ,,
Fig. 10.—*Aphalara fuscipennis*, n.sp. ,,
Fig. 11.—*Eriopsylla gracilis*, n.sp. ,,
Fig. 12.—*Psylla candida*, n.sp. ,,

Plate xv.

Fig. 1.—*Brachypsylla tryoni*, n.sp.; wing.
Fig. 2.—*Syncarpiolyma maculata*, n.sp.; wing.
Fig. 3.—*Thea olivacea*, n.sp. ,,
Fig. 4.—*Trioza banksiæ*, n.sp. ,,
Fig. 5.—*Tyora sterculiæ*, n.sp. ,,
Fig. 6.—*Cardiaspis textrix*, n.sp. ,,
Fig. 7.—*Mycopsylla fici*, Tryon ,,
Fig. 8.—*Tyora hibisci*, n.sp. ,,
Fig. 9.—*Trioza orbiculata*, n.sp. ,,
Fig. 10.——— *eugeniæ*, n.sp. ,,
Fig. 11.——— *casuarinæ*, n.sp. ,,
Fig. 12.——— *carnosa*, n.sp. ,,
Fig. 13.—*Psylla sterculiæ*, n.sp. ,,

Plate xvi.

Fig. 1.—*Brachypsylla tryoni*, n.sp.; genitalia (♂).
Fig. 2.—*Psylla frenchi*, n.sp. ,,
Fig. 3.——— *acaciæ-baileyanæ*, n.sp. ,,
Fig. 4.—*Thea olivacea*, n.sp. ,,
Fig. 5.—*Psylla acaciæ-decurrentis*, n.sp. ,,
Fig. 6.—*Eriopsylla viridis*, n.sp. ,,
Fig. 7.—*Syncarpiolyma maculata*, n.sp. ,,
Fig. 8.—*Mycopsylla proxima*, n.sp. ,,
Fig. 9.—*Eriopsylla gracilis*, n.sp. ,,
Fig. 10.—*Tyora sterculiæ*, n.sp. ,,
Fig. 11.—*Eucalyptolyma maideni*, n.sp. ..
Fig. 12.—*Trioza carnosa*, n.sp. ..
Fig. 13.—*Psylla acaciæ-pendulæ*, n.sp. ..
Fig. 14.——— *capparis*, n.sp. ..
Fig. 15.—*Trioza eugeniæ*, n.sp. ..
Fig. 16.—*Psylla candida*, n.sp. ..
Fig. 17.—*Mycopsylla fici*, Tryon ..
Fig. 18.—*Tyora hibisci*, n.sp. ..
Fig. 19.—*Cardiaspis textrix*, n.sp.; lerp-net.
Fig. 20.—*Eucalyptolyma maideni*, n.sp.; lerp scale.
Fig. 21.— *erratica*, n.sp.; .. ..
Fig. 22.—*Trioza orbiculata*, n.sp.; lerp gall.
Fig. 23.——— *eucalypti*, n.sp.; gall.
Fig. 24.——— *carnosa*, n.sp. ..
Fig. 25.—*Spondyliaspis granulata*, n.sp.; lerp.
Fig. 26.—*Trioza banksiæ*, n.sp.; pupa.
Fig. 27.——— *casuarinæ*, n.sp.; pupa.

NOTE ON THE OCCURRENCE OF DIATOMS, RADIOLARIA AND INFUSORIA IN THE ROLLING DOWNS FORMATION (LOWER CRETACEOUS), QUEENSLAND.

By W. S. Dun, W. H. Rands, F.G.S., and Professor David, B.A., F.G.S., F.R.S.

(Plates xvii.-xix.)

i.—Introductory.

This note is intended to be preliminary to a fuller description which we hope to furnish later when a larger supply of the material is available.

Some years ago, by the courtesy of Mr. R. L. Jack, the late Govt. Geologist of Queensland, one of the authors was allowed to take a chip of limestone from a specimen in the Geol. Survey Museum, Brisbane, with a view to examine it for Radiolaria. The specimen came from the Maranoa River, Queensland, from a bed of limestone interstratified in the Lower Cretaceous (Rolling Downs) Formation. This particular piece of limestone was selected for special examination because its surface had weathered into a soft brown crust like Bath brick, closely resembling in this respect the Middle Devonian radiolarian limestones of Tamworth, N.S. Wales. An examination for radiolaria of thin sections of this rock under an inch objective proved disappointing, and the sections were put aside, but on being re-examined about two months ago with a ¼ inch objective with a view to studying the nature of the network of a fragmental radiolarian shell, it was observed that numerous black particles, which under the lower power appeared structureless, now showed definite structure.

Subsequent examination convinced us that many of these forms were Diatoms, and some probably Infusoria.

(*a*) *Diatoms.*—Diatoms in rocks older than the Tertiary being of comparatively rare occurrence, the literature on the subject is not extensive, so that a short reference to the principal papers may be given here.

Summarising what is at present known about the fossil Diatomaceæ, Seward* says :—"With the exception of two species of Liassic Diatoms, no trustworthy examples of the *Diatomaceæ* have been found below the Cretaceous Series. The oldest known Diatoms were discovered by Rothpletz† among the fibres of an Upper Lias Sponge from Boll in Württemberg. . . . Rothpletz describes two species which he includes in the genus *Pyxidicula*, *P. bollensis* and *P. liassica.*"

The siliceous frustules referred to these species occur in great numbers, associated with coccoliths, among the horny fibres of the fossil sponge *Phymatoderma.* The frustules are thimble-shaped, minutely punctate or perforate (apparently the latter to judge from the figures), and measure in greatest diameter 6-14 μ. They are usually isolated, but very rarely are met with in pairs united at their open ends, the two portions in this case being of unequal size. They do not, however, overlap one another, neither is any girdle present.

Rothpletz compares these forms with the genus *Stephanopyxis* (Schütt) and the sub-genus *Pyxidicula* (Schütt). The former possesses spines on both valves, while the latter is devoid of spines. Rothpletz figures (*op. cit.*, p. 911) a form of *Stephanopyxis* from the Oligocene marl of Thisted in Denmark. Many Cretaceous Diatoms have been figured by Ehrenberg‡ from the

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* Seward, Fossil Plants, Vol. i., p. 154.

† Rothpletz, Ueber die Flysch-Fucoiden und einige andere fossilen Algen sowie über liasische Diatomeen führende Hornschwamme. *Zeits. Deutsch. Geol. Gesell.*, 1896, xlv., pp. 854-914. Also, Nachtrag zu meinem Aufsatz über einen neuen Jurassischen Hornschwamme und die darin eingeschlossenen Diatomeen. *Op. cit.*, 1900, lii., pp. 388-389.

‡ Ehrenberg (C. G.), Mikrogeologie. Leipzig, 1854. Und Forsetzung.

Austrian deposits. He remarks that the Tertiary and Cretaceous Diatoms show a very marked resemblance to living forms.

Unfortunately we have not at present access to most of Ehrenberg's works.

Cayeux* has also recorded the occurrence of Cretaceous Diatoms in France. In these deposits the skeleton is replaced by carbonate of lime.

These Diatoms are referred chiefly to *Triceratium.*

Rüst† has figured a *Coscinodiscus* from the coprolites of the Jurassic strata of Ilsede in Hanover, and from the same rocks several species of the infusorian *Tintinnus.*

Count Castracane‡ has described what he considers to be Diatoms from the Carboniferous rocks of France, England and Scotland.

The origin, however, of these diatoms is questioned by many palæobotanists, the general opinion being that they are adventitious rather than *in situ.*

(*b*) *Radiolaria.*—As regards radiolaria, the remains of these exclusively marine micro-organisms have been found in sedimentary rocks of almost all ages, and Cretaceous forms have been described by Hinde,* Rüst,† Cayeux,‡ and others. A general summary of the more recent literature relating to fossil radiolaria is given by one of us in papers read before this Society in 1896.§

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* Cayeuz (L.), Contribution à l' étude des Terrains Sédimentaires. *Mém. Soc. Géol. Nord.* iv., 2. See specially pp. 61, 375, 458.

He says, *op. cit.*, p. 458, "Celles [Diatomées] que j'ai observées sont indépendantes des silex J'en ai trouvé dans la craie à *I.* [*Inoceramus*] *labiatus* de la vallée du Cher et dans la craie à *M. breviporus* du Bray. Elles sont extrêmement rares de part et d' autre. La determination n'en est pas encore faite. J'en ai également s ignalé la présence dans le Campanien silicieux du S. O. du Bassin."

Also, "Sur la présence de nombreuses Diatomées dans les gaizes jurassiques et crétacées du Bassin de Paris. De l' existence de Radiolaires dans les gaizes crétacées de ce même Bassin." *Ann. Soc. Géol. Nord.* xx., 1892, pp. 57-60.

† Rüst, Beiträge zur Kenntniss der fossilen Radiolarien aus Gesteinen des Jura. Palaeontographica, xxxi., pl. xliv. (xix.), p. 320.

‡ Comptes rendus Acad. Sci., Paris, 1874, lxxix., p. 52.

It will not be out of place to casually refer to the great series of radiolarian-bearing rocks of Devonian age occurring at Tamworth, the micro-fauna of which has been so thoroughly investigated by Dr. Hinde.

As regards radiolarian rocks in Australia which may belong to the same geological system as those of the Maranoa River, Queensland, the fact may be mentioned that the rock from Fanny Bay, Port Darwin, is considered to be very probably of Upper Cretaceous (Desert Sandstone) age, and Dr. Hinde, in describing it, says:—"The rock in question is of a dull white or yellowish-white tint, in places stained reddish with ferruginous material; it has an earthy aspect, like that of our Lower White Chalk, though it can be scratched by the thumb-nail." Tenison-Woods, in his "Report on the Geology and Mineralogy of the Northern Territory," described the cliffs as being capped by beds of compact white or yellowish-white rock, for the most part magnesite. Dr. Hinde, in speaking of the mode of occurrence of the rock, says:—"Mr. Bassett-Smith states that the white radiolarian rock forms a very prominent feature in the steep cliffs, from 30 to 50 feet in height, which border the harbour of Port Darwin. The rock is exposed for many miles on the Fanny Bay side of the harbour, and extends continuously from point to point across the bay. A section in the cliff at Fanny Bay consists at the base of mica-schist and quartz, on which discordantly rests a narrow band of soft ochre-like clay, followed above by the white radiolarian rock, which varies in places from 10 to 30 feet in thickness. It is covered by a layer of ironstone conglomerate, of a few feet in thickness, which caps the cliff. The white rock appears to be nearly horizontal; it contains, more particularly in the upper portion, numerous nodules, varying in size from that of a walnut to that of a cocoanut. In weathering it becomes soft and shows a great variety of tints, from pure white to deep red. No fossils can be found in it. It is used extensively for building purposes, and it is eaten by the natives, probably on account of its purgative properties. Mr. Bassett-Smith further states that the white radiolarian rock is unaffected by heated hydrochloric or nitric acid, and it is the same as that designated 'magnesite' in Tenison-Wood's report. It thus seems probable that this material, so widely distributed in the northern area of Australia, and reaching in places a thickness of 130 feet, may prove to be, as already suggested, a deep-sea deposit of radiolarian origin."

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* Note on a Radiolarian Rock from Fanny Bay, Port Darwin, Australia. *Quart. Journ. Geol. Soc.*, 1893, xlix., pp. 221-226, pl. 5.

† Palaeontographica, 1885, xxxi., pp. 269-322; 1888, xxxiv., pp. 181-213; 1892, xxxviii.

‡ Contribution à l'étude micrographique des Terrains Sédimentaires. *Mém. Soc. Géol. Nord*, 1897, pp. 185-206, pls. 7, 8.

§ David (T. W. E.), The Occurrence of Radiolaria in Palæozoic Rocks in N.S. Wales. *P.L.S.N.S.W.*, xxi., pp. 553-570, pls. 37, 38. David and Howchin, Note on the Occurrence of Casts of Radiolaria in Pre-Cambrian (?) Rocks, South Australia. *Ibid.*, pp. 571-582, pls. 39, 40.

The forms described belong to the suborders Prunoidea, Discoidea, and Cyrtoidea, and comprise the following genera and species:—

PRUNOIDEA—*Cenellipsis.*
DISCOIDEA —*Astrophacus*, spp. *a.* & *b.*
Lithocyclia exilis.
Amphibrachium crassum.
,, *truncatum.*
,, *fragile.*
,, sp.
Spongodiscus expansus.
,, spp.
Spongolena symmetrica.
CYRTOIDEA —*Dictyomitra australis.*
,, *triangularis.*
Lithocampe fusiformis.
Stichocapsa pinguis.
,, *chrysalis.*

One noteworthy fact about these Port Darwin radiolaria is that no spine-bearing forms are preserved, a fact that apparently is to be noticed in the case of the Maranoa specimens also.

(*c*) *Infusoria.*—As far as we are aware fossil Infusoria have not been recorded previously from Australia.

Dr. Rüst (*op. cit.*), as already stated, has recorded their occurrence in the Jurassic rocks of Ilsede in Hanover.

ii.—MODE OF OCCURRENCE.

In the months of October and November of the year 1885 Mr. (now Dr.) R. L. Jack made a journey through the southern part of the western interior in company with Mr. J. B. Henderson, the Hydraulic Engineer, with the object of fixing a site to bore for artesian water.

In the Maranoa River, about half-a-mile north of Mitchell, Dr. Jack found bands of a dark-coloured limestone in blue shales. This limestone occurs in the Rolling Downs Beds not far from their base.

In the "Geology and Palæontology of Queensland," by Jack and Etheridge, Dr. Jack describes these rocks briefly as follows:—"On the Maranoa River, about half-a-mile north of the railway, are blue shales with bands of limestone nodules. The shales and limestones at the lowest point down the river dip up the river at about 15 deg. The remainder of the section dips, if anything, up the river, but is practically horizontal. From the limestone nodules I obtained numerous fossils, among which my colleague recognised the Pelecypoda, of which a list is given on a subsequent page" (p. 404).

The fossils are as follows:—

PELECYPODA — *Maccoyella Barklyi*, Moore.
Pseudavicula anomala, Moore.
Corbicella (?) *maranoana*, Eth. fil.
Glycimeris Tatei, Eth. fil.
,, *rugosa*, Moore.
Gastrochæna australis, Eth. fil.
GASTEROPODA—*Natica variabilis*, Moore.

Mr. R. Etheridge, junr., adds a footnote to the effect that in a collection from the Lake Eyre Basin, submitted to him by Prof. R. Tate, an exactly similar matrix and mode of preservation of the fossils exists.

A sketch section is attached showing the position of the limestone (Plate xvii.).

iii.—DESCRIPTION OF THE FORMS FIGURED.

In a preliminary note like the present we have selected for figuring two forms which we believe to be Diatoms, one example of the Radiolaria, and one which we believe to be an Infusorian type, allied to, if not identical with, *Tintinnus*.

Nearly all the micro-organisms are preserved in the form of jet black material, with the exception of the Diatom (Pl. xviii., fig. 2). The latter is most frequently represented by a cast in clear calcite, but in several cases a black network can be seen enveloping the calcite.

As regards their mineral constitution, on treatment in dilute acetic acid it is found that the greater part of the netted forms disappear completely. Those which are left intact are mostly *Coscinodiscus*, or some allied type of Diatom. So far as our experiments went, no Radiolarian shells were noticed among the residues after treatment with acetic acid, which suggests either that the skeletons visible in the thin sections of the Maranoa limestones have been replaced by calcite, or that the skeleton was originally acanthinous. The fact that most of the black nets disappear after treatment with acetic acid, considered in conjunction with their shape and size, suggests that they are Infusorian loricæ, and that these organisms outnumbered the Diatoms and Radiolaria in the Maranoa limestones.

(*a*) *Diatoms.*—The form referred by us to the genus *Coscinodiscus* (Pl. xviii., fig. 1.) is disc-shaped and circular in outline.

Its diameter is 0·095 mm., and the diameter of the meshes varies from 0·00125 mm. to 0·0017 mm. The disc is slightly convex, the amount of departure from a plane surface at the centre of the disc being about from 0·0004 to 0·0005 mm. The openings in the mesh-work appear to be sub-hexagonal, and the width of the dark bars of the mesh-work is only a little less than the diameter of the openings, viz., about 0·001 mm.

There are from 33 to 34 meshes to the full diameter of the disc.

In the figure the frustule is magnified (× 350 diameters).

Diatom genus (?).—The sections of which a photograph and drawing are shown on Pl. xviii., fig. 2, and Pl. xix., fig. 1, were originally mistaken by us for a naviculoid type of diatom; we were inclined at first to refer it to *Nitzschia*, then to *Amphora*. Later it was noticed that in some of the sections a distinct delicate hexagonal mesh-work was visible on one or both sides. The mesh-work appears to be more distinctly hexagonal than that of *Coscinodiscus*, and the bars of the network seem to be of about the same diameter as those of the latter type. The diameter of the openings in the mesh-work varies from about 0·003̇ to 0·0036 mm.; and the diameter of the bars of the mesh-work is about 0·001 mm. The girdle (?) view of this form shows that the hexagonal netting extends completely across the ends, but it would appear that the mesh-work on the girdle (?) is rather smaller than that on the valve surfaces Hitherto, however, we have been unable to obtain accurate measurements of their size, neither have we been able to ascertain whether there is any trace of overlapping laminæ in what we take for the girdle zone. We believe that the sections illustrated on Pl xviii., fig. 2, and Pl. xix., fig. 1, are radial sections through a biconvex form becoming slightly biconcave towards the edges. The girdle (?) is a comparatively wide median zone measuring about 0·01 mm. in inside diameter, and 0·0175 mm. in outside diameter. A fact opposed to the view that the ends of the forms figured represent radial sections cut through the girdle, is that in many of the sections one end appears to be wider than the other. In such cases, however, it is doubtful whether the specimen is completely preserved so as to show the complete girdle face at each end. The extreme outer diameter, measured parallel to the long axis of the figure, is 0·1675 mm., and the extreme inner therefore, nearly twice that of the *Coscinodiscus* figured by us. The greatest transverse outside diameter. measured at right angles to the long axis of the figure of the form shown on Pl. xix., fig. 1, is 0·025 mm., and the greatest internal measurement, in the same direction, is about 0·018 mm. There seems to be a distinct wall present inside the hexagonal network. This wall is about 0·003 mm. thick, and at first sight appears to be perforated, but it is doubtful whether it really is so. The thickness of the wall at the ends (the girdle [?]) is about 0·0016 mm.

As regards the mineral constitution of the comparatively thick wall, it is seen to be chiefly calcite, when examined in polarised light.

That the sections figured are diagonals of discs cut approximately at right angles to the valve surfaces of the disc, is rendered probable by the occasional occurrence of associated circular forms, which, in one case at least, agree in measurement exactly with the form figured (Pl. xviii., fig. 1). These circular forms also exhibit in some cases a hexagonal mesh-work. Blackish opaque spherical bodies are visible in most of the specimens of this type of Diatom (?). Some of these are figured on Pl. xix., fig. 1. They vary in diameter from about 0·005 to 0·01 mm.

(*b*) *Radiolaria.*—Complete shells are rare, but fragments of radiolarian skeletons are plentiful. One of the most complete forms observed is figured by us on Pl. xviii., fig. 3, and Pl. xix., fig. 3. It consists of three concentric shells, united by radiating cross-bars.

The extreme diameter of the cortical shell (outside measurement) is 0·11 mm. The extreme diameter of the middle shell (outer medullary test [?]) is 0·045 mm., and that of the inner medullary shell 0·0225 mm. This genus agrees fairly well in shape and size with the form figured by Dr. Hinde (*op. cit.*) from Port Darwin as *Astrophacus*.

(*c*) *Infusoria*—*Tintinnus* sp.—The form figured belongs to a type which is very abundant and characteristic in this rock. It resembles a syringe in shape. The lorica is formed of a delicate black hexagonal mesh-work. Its greatest length, as preserved, is 0·0835 mm., and the width 0·007 mm. The diameter of the meshes is about 0·0015 mm.

This form resembles that figured by Rüst in "Palaeontographica," 1885 (Vol. xxxi., Pl. xliv. (xix.), fig. 1) from the Jurassic coprolites of Ilsede in Hanover, and the recent form figured by Saville Kent in his Manual of the Infusoria (1880-1882, Vol. iii., Pl. xxxi., figs. 18-19). This form is *Tintinnus denticulatus*, Ehr. Saville Kent states (*op. cit.*, Vol. ii., p. 607) that this form is salt water in its habit, and that it is found in the Baltic Sea and on the Norwegian coast, and that its distribution would appear to be general and abundant throughout the seas of Northern Europe. Kent, however, describes its lorica as having its "surface regularly shagreened with minute hexagonal facets," whereas in the Queensland Lower Cretaceous form the lorica consists of open hexagonal meshwork, resembling in this respect the form figured by Rüst.

A great variety of loricæ of infusoria are visible in this limestone, but for the present we defer figuring them until more of the material is available.

We beg to gratefully acknowledge the very valuable help that has been given us by Mr. L. C. Green of the Geological Survey of Queensland, who has bestowed much time and care in obtaining for us microphotographs of the organisms figured in the plates.

We also desire to thank Mr. T. Steel, F.L.S., for his kind loan to us of Adolf Schmidt's "Atlas der Diatomaceen-Kunde," and other works relating to Diatoms, and would express our obligations to Mr. J. P. Hill, B.Sc., for his loan to us of his collection of Diatoms, and to Prof. Haswell, F.R.S., for numerous references to works dealing with the Infusoria.

EXPLANATION OF PLATES.

Plate xvii.

Section showing the Horizon of the Lower Cretaceous Limestone containing Diatoms, Radiolaria and Infusoria, from Maranoa River, Queensland. By W. H. Rands, F.G.S.

Plate xviii.

Fig. 1.—*Coscinodiscus* sp. Lower Cretaceous (Rolling Downs) Formation; Maranoa River, Queensland (× 350). Photo by L. C. Green.

Fig. 2.—*Diatom*, genus (?). Lower Cretaceous (Rolling Downs) Formation; Maranoa River, Queensland (× 350). Photo by L. C. Green.

Fig. 3.—Radiolarian shell consisting of three concentric shells, perhaps *Astrophacus*, from Lower Cretaceous (Rolling Downs) Formation; Maranoa River, Queensland (× 350). Photo by L. C. Green.

Plate xix.

Fig. 1.—*Diatom*, genus (?). Similar to above (× 350).

Fig. 2.—*Tintinnus* sp., from Lower Cretaceous (Rolling Downs) Formation; Maranoa River, Queensland (× 900).

Fig. 3.—Drawing of Radiolarian shell (Pl. xviii., fig. 3), showing details of structure.

NOTES AND EXHIBITS.

Mr. A. A. Hamilton exhibited a series of botanical specimens of interest, including:—

Dodonæa pinnata, Sm.—Hawkesbury River (W. Forsyth and A. A. Hamilton; 4th July, 1897). Both the Flora Australiensis and the Handbook of the Flora of N.S. Wales describe the male plant only, mentioning that the female plant with capsules had not been seen. Woolls also, in his "Contributions to the Flora of Australia" (p. 133), mentions that he had once collected a pinnate variety of *Dodonæa* near Hunter's Hill, which he was inclined to regard as one of the pinnate series of the genus; but as he had never been able to find another similar shrub subsequently, he was satisfied with Baron von Mueller's reference thereof to *D. viscosa*. Specimens of the female plant with capsules from the Hawkesbury are also in the Botanical Gardens Herbarium (Mr. J. L. Boorman; November, 1897) and Erskine Creek, Nepean River (Mr. J. H. Maiden; September, 1888).

Panicum obseptum, Trin.—Centennial Park (May 19th, 1901; A. A. Hamilton). This grass is recorded in the Flora Australiensis from Port Jackson and Richmond (Woolls). Bentham states that he had not seen the specimen from Port Jackson forwarded by Trinius to Lindley. A specimen in the National Herbarium is from Richmond (Coll. Woolls). There are several patches of this grass on the margin of one of the ponds in the Centennial Park.

Cyperus tetraphyllus, R.Br.—Lily Vale (May 24th, 1899; A. A. Hamilton). Recorded in the Flora Australiensis from Queensland, south to Newcastle; collected at the latter place by Dr. Leichhardt; and in the Handbook of the Flora of N.S. Wales, Hunter River to Queensland.

Lomaria capensis, Willd.—Kogarah Bay (A. A. Hamilton; June 3rd, 1901). The pinnæ of both the fertile and the sterile fronds are abnormally lobed, and over four feet in length.

Mr. Harper exhibited "onvars" or thumb-guards from Malekula, the modification in use in Efate, and examples of the plaited arm-guards—sometimes erroneously termed armlets—of New Guinea, together with specimens of the bows and arrows used in conjunction therewith. Also deformed Malekulan crania to illustrate photographs sent to him by Mr. R. Parkinson, of New Britain, who had recently found amongst the inhabitants of South Cape, New Britain, exactly the same deformation as that practised by the people of South Malekula and the Maskelyne Islets.

Professor David exhibited rock specimens, and sections under the microscope to illustrate the occurrence of minute organisms in certain beds of the Rolling Downs Formation.

Mr. Froggatt exhibited a fine collection of Australian Psyllids in illustration of his paper.

WEDNESDAY, JULY 31st, 1901.

The Ordinary Monthly Meeting of the Society was held in the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, July 31st, 1901.

Mr. J. H. Maiden, F.L.S., &c., President, in the Chair.

DONATIONS.

Department of Agriculture, Brisbane—Queensland Agricultural Journal. Vol. ix. Part 1 (July, 1901). *From the Hon. the Secretary for Agriculture.*

Home Secretary's Department, Brisbane—North Queensland Ethnography. Bulletin. Nos. 1-2 (January-April, 1901). *From* [illegible]

[illegible] Survey of Queensland—Annual Report for the [illegible] Report on Stannary Hills [illegible] and [illegible] Geology and Reefs of the [illegible] M. Maclaren, B.Sc.; [illegible] Fields [illegible], and On [illegible] Mining Industry in the [illegible] Cameron, B.A. *From the* [illegible]

[illegible] No. 3 July. [illegible]

[illegible] Bureau of [illegible] *from the Hon.* [illegible]

One Separate (from the Agricultural Gazette of N.S.W. for 1901, being Miscellaneous Publication, No. 475). By C. A. Benbow. *From the Author.*

Royal Anthropological Society of Australasia, Sydney—Science of Man. Vol. iv. n.s. Nos. 5-6 (June-July, 1901). *From the Society.*

Royal Society of New South Wales, Sydney—Abstract of Proceedings, July 3rd, 1901. *From the Society.*

University of Sydney—Calendar for the Year 1901. *From the Senate.*

Australasian Journal of Pharmacy, Melbourne. Vol. xvi. No. 187 and Supplement (July, 1901). *From the Editor.*

Field Naturalists' Club of Victoria, Melbourne—Victorian Naturalist. Vol. xviii. No. 3 (July, 1901). *From the Club.*

One Separate (from the Victorian Naturalist. Vol. xvii. No. 10; Feb., 1901). By D. McAlpine, Government Vegetable Pathologist. *From the Author.*

Geological Survey of Western Australia, Perth—Mining Map of the Boulder Belt, East Coolgardie (two sheets; 1900). *From the Government Geologist.*

Department of Mines, Hobart—Government Geologist's Report on the Mining Districts of the Scamander River and St. Helen's (1901). *From the Secretary for Mines.*

Manchester Literary and Philosophical Society—Memoirs and Proceedings. Vol. xlv. Part ii. (1900-01). *From the Society.*

One Separate: Appendix to "Great and Small Game of Africa" (Description of Ward's Reedbuck, *Cervicapra redunca wardi*). By H. A. Bryden. *From the Publishers, Messrs. Rowland Ward, Ltd.*

Royal Microscopical Society, London—Journal, 1901. Part 3. *From the Society.*

Royal Society of London—Proceedings. Vol. lxviii. Nos. 445-446 (May-June, 1901). *From the Society.*

Zoological Society of London—Abstract of Proceedings, May 21st, June 4th and 18th, 1901: Proceedings, 1900. Part iv. (April, 1901): Transactions. Vol. xv. Parts 6-7 (April, 1901). *From the Society.*

American Academy of Arts and Sciences, Boston—Proceedings. Vol. xxxvi. Nos. 9-15 (October, 1900-January, 1901). *From the Academy.*

American Museum of Natural History, New York—Bulletin. Vol. xiv. Articles xi.-xii., pp. 149-197 (June, 1901). *From the Museum.*

American Philosophical Society, Philadelphia—Proceedings. Vol. xxxix. No. 164 (October-December, 1900). *From the Society.*

Museum of Comparative Zoology, Harvard College, Cambridge, Mass.—Bulletin. Vol. xxxviii. Geological Series. Vol. v. No. 4 (May, 1901). *From Professor A. Agassiz.*

Nova Scotian Institute of Natural Science, Halifax—Proceedings and Transactions. Vol. x. Part 2 (1899-1900). *From the Institute.*

Smithsonian Institution, Washington—Annual Report of the Board of Regents for Year ending June 30th, 1898. *From the Secretary.*

U.S. Department of Agriculture, Washington—Yearbook for 1900: *Division of Botany.* Bulletin, No. 25 (1901). *From the Secretary for Agriculture.*

Indian Museum, Calcutta — Descriptive Catalogue of the Indian Deep-Sea Crustacea Decapoda, Macrura and Anomala in the Museum (1901); Zoological Gleanings from the Royal Indian Marine Survey Ship "Investigator" (1901). By A. W. Alcock, M.B., C.M.Z.S. *From the Trustees.*

Perak Government Gazette, Taiping. Vol. xiv. Nos. 18-20 (May-June, 1901). *From the Government Secretary.*

South African Philosophical Society, Cape Town—Transactions. Vol. xii., pp. 1-563 (1901). *From the Society.*

Zoologischer Anzeiger, Leipzig. xxiv. Band. Nos. 644-646 (May-June, 1901). *From the Editor.*

Entomologischer Verein zu Berlin—Berliner Entomologische Zeitschrift. xlvi. Band. 1 Heft (1901). *From the Society.*

Naturwissenschaftlicher Verein für Steiermark in Graz—Mittheilungen. Jahrgang 1900. *From the Society.*

Société Géologique de Belgique—Annales. Tome xxviii. 2ᵉ Livraison (Mai, 1901). *From the Society.*

Société Royale de Géographie d'Anvers—Bulletin. Tome xxv. 2ᵉ Livraison (1901). *From the Society.*

Académie Impériale des Sciences de St. Pétersbourg—Mémoires viiiᵉ. Série. Vol. x. Nos. 3, 5-6 (1990). *From the Academy.*

Russisch-Kaiserliche Mineralogische Gesellschaft zu St. Petersburg—Verhandlungen. Zweite Serie. xxxviii. Band. .ii. Lief. (1900). *From the Society.*

Société des Naturalistes de la Nouvelle-Russie, Odessa—Mémoires. Tome xxiii. Parts i.-ii. (1899-1990). *From the Society.*

Société des Naturalistes de Kiew—Mémoires. Tome xvi. Livraison 2 (1900). *From the Society.*

Société Impériale des Naturalistes de Moscou—Bulletin. Année 1899. No. 4; Année 1900. No. 3. *From the Society.*

Société Royale des Sciences, Upsal—Nova Acta. Ser. iii. Vol. xix. (1901). *From the Society.*

Académie Royale des Sciences et des Lettres de Danemark, Copenhague—Oversigt, 1901. Nos. 2-3. *From the Academy.*

Nederlandsche Dierkundige Vereeniging, Helder—Tijdschrift. 2ᵈᵉ Serie. Deel. vii. Afl. 1 (1901); Aanwinsten van de Bibliotheek, 1 Januari-31 December, 1900. *From the Society.*

La Nuova Notarisia, Padova. Serie xii. Aprile, 1901. *From the Editor, Dr. G. B. De Toni.*

Società Entomologica Italiana, Firenze—Bullettino. Anno xxxiii. Trimestre i. (1901). *From the Society.*

College of Science, Imperial University of Tōkyō—Journal. Vol. xv. Part ii. (1901). *From the University.*

Kyoto Imperial University—Calendar for 1900-1901. *From the University.*

NOTES ON THE BOTANY OF THE INTERIOR OF NEW SOUTH WALES.

By R. H. Cambage.

(Plates xx.-xxi.)

Part IV.—From Mount Hope to Parkes.

The road taken from Mount Hope to Condobolin was across Wirchilleba, Eremeran, and part of Melrose Stations, keeping back from the Lachlan River all the way.

In passing between Mount Allen and Double Peak, which are two hills situated about four miles apart, it was noticed that on the former there was a considerable quantity of *Casuarina quadrivalvis* (She Oak), but not a single tree of it was found on the latter. *Sterculia diversifolia* (Currajong) was also much more plentiful on the former than on the latter. On the other hand, *Acacia doratoxylon* (Currawong) was found covering the heights of Double Peak, its straight stems standing out against the sky-line along the top of the ridge giving it the well known hog's-neck appearance; while on Mount Allen the species does not appear to be represented at all. The formation of Mount Allen is igneous, apparently porphyry, while that of Double Peak, also known as Dromedary, is Silurian slate, with a few belts of porphyry.

Various trees and shrubs noticed between Double Peak and Wirchilleba Homestead were:—*Callitris robusta* (White or Cypress Pine), *Heterodendron oleæfolium* (Rosewood), *Fusanus acuminatus* (Quandong), *Hakea leucoptera* (Needlewood), *Bertya Cunninghamii* (Broom Bush), *Bossiæa* sp., *Triodia irritans*

(Spinifex), growing in the Mallee scrub, *Myoporum deserti* (Dogwood), *Callitris verrucosa* (Spreading Pine), *Apophyllum anomalum* (Currant or Warrior Bush), *Dodonæa viscosa*, var. *attenuata* (Hopbush), *Capparis Mitchelli* (Wild Orange), *Cassia eremophila*, *Eremophila longifolia* (Emu Bush), *E. Mitchelli* (Budtha), *Geijera parviflora* (Wilga), and the large climber, *Lyonsia eucalyptifolia*.

In one place the Cypress Pine was found forming a dense almost impenetrable scrub extending along the road for 3 or 4 miles.

The Acacias noticed were :—*A. homalophylla* (Yarran), *A. Oswaldi*, *A. aneura* (Mulga), *A. doratoxylon*, *A. hakeoides* (sometimes called Black Wattle), *A. Burkittii* (Kangaroo Bush), and *A. decora* (Silver Wattle).

The Eucalypts were represented by *E. populifolia* (Bimble Box), *E. intertexta* (Gum or Yellow Box), *E. viridis* (Narrow-Leaf or Whipstick Mallee), *E. oleosa*, and *E. dumosa*, the last two forming a Mallee scrub for several miles. In this scrub *E. intertexta* was noticed in some instances assuming the Mallee form, having short stems and several from one root, but this is rather an unusual feature with this species. On a creek near the Homestead is *E. rostrata* (River Red Gum).

Between Wirchilleba and Eremeran Homesteads the vegetation continues much the same, as will be seen by the names of the following trees and shrubs which were passed, there being *Callitris robusta*, *Dodonæa viscosa*, var. *attenuata*, *Hakea leucoptera*, *Apophyllum anomalum*, *Heterodendron oleæfolium*, *Eremophila Mitchelli*, *E. longifolia*, *Geijera parviflora*, *Sterculia diversifolia*, *Cassia eremophila*, *Eriostemon difformis*, *Scævola spinescens*, *Bassia* sp. among the Mallee, *Myoporum deserti*, *Pittosporum phillyræoides*, *Olearia* sp., *Exocarpus cupressiformis* (Native Cherry), and *Tecoma australis* (Bignonia).

Close to Wirchilleba is a shrub with sticky leaves, and in appearance something like *Eremophila Mitchelli* (previously mentioned in Part iii., p. 709).

Casuarina [illegible] was found growing near Eremeran Homestead, where the formation for some miles is granite.

Near here also is *C. Luehmanni*, Baker (Bull Oak), the first met with in coming from Bourke. This tree has an extensive range, and is very common in the Forbes to Dubbo districts. Although it does not appear to grow in the direct line between Bourke and Euabalong, yet to the east of this line it extends north and south, covering a strip of country at least 100 miles wide, and finally going north-west to Barringan (R. T. Baker) on the Queensland border. Its easterly course is stopped as soon as the cold highlands are approached, it being a distinctly warm country species. The most eastern points are reached by its creeping up along the valleys of the large rivers. Near the Lachlan there are a few trees on Neila station, six miles south-east of Cowra. Along the elevated parts of the Macquarie it may be found in limited quantities between Hill End and Bathurst, but its highest point is reached above the latter place, at one mile east of O'Connell; on the south side, and close to the Fish River, there are about a dozen stunted trees growing on a granite bluff. The specimens collected had only fruit in a very young stage, but the whole of the evidence available, including bark and wood, points to the conclusion that they have been properly identified. The land around is occupied, and it is likely that before long the species will be extinct in this locality. In no other place have I found it growing at an altitude exceeding 2,000 feet above sea level, and seldom above 1,500 feet. The fact of these trees being stunted may be accounted for by their being in a climate too cold for them; but whether they are the remnants of a former luxuriant growth in this locality or simply a few stragglers outside their regular limit, are questions which cannot be answered without considerable investigation It is fully 25 miles down the river from O'Connell before any other trees of Bull Oak are found, though possibly others may have existed before the country was cleared.

In many localities *C. Luehmanni* grows near *C. Cambagei* (Belah), but is easily distinguished from that species by its rougher bark, thicker branchlets, smaller fruits, and more especially its timber, which is full of medullary rays, that of Belah showing practically none. In old trees of Bull Oak the rough corky bark often falls off, thus giving the trunk a somewhat smoother appearance.

In comparing the figure caused by the medullary rays in wood from two species, it is necessary that the trees from which the specimens are taken should be of about the same size, or the results may be misleading. Thus a large tree of *C. Luehmanni* will show broader rays than a small tree of *C. quadrivalvis* and vice versâ.

The fruits of Bull Oak may generally be identified by their having both ends flat, the cone itself being made up of three rings or whorls of seeds. It usually happens that in the flowering stage some of the ovules escape being fertilised, and consequently do not grow, the result being that the rings present a notched or unfinished appearance. In the Lachlan district the fruits mature about the month of January.

Recently I found *C. Luehmanni* in Victoria and South Australia, though previously it had not been recorded outside of New South Wales. The circumstances surrounding this discovery are somewhat unusual. Arriving at Serviceton at 11 p.m., and having to wait four hours for the next train, I decided to have a look at the flora, notwithstanding the lateness of the hour and the absence of the moon. After going about half a mile, I saw the outline of a tree top appearing in the star-light. While standing under it, feeling the bark, a slight breeze suddenly stirred the foliage, and from that well known murmuring sound came the assurance that the tree was a Casuarina. After searching a few more trees, mature fruits were found, which proved the species to be *C. Luehmanni.* Serviceton is in Victoria, close to the South Australian boundary, but subsequently I found that the species extends about 12 miles into the latter State, while it is within sight of the railway for many miles in Victoria, near Horsham, Murtoa, Lubeck, &c.

It thus extends, somewhat in a semicircle, from South Australia, across the north-west corner of Victoria, right through New South Wales, and possibly a short distance into Queensland.

After finding the Bull Oak at Serviceton, I continued my search and found another species, specimens of which were handed to Mr. J. G. Luehmann, F.L.S., Curator of the National Hebarium, Melbourne, who informed me that this second tree was *Eucalyptus odorata*, Behr., not previously (except erroneously) recorded for Victoria. The species which had been incorrectly identified as *E. odorata* is *E. Bosistoana*, F.v.M. *E. odorata* would, if found in New South Wales, certainly be called a Box-tree, as it looks like a stunted form of *E. Woollsiana*, though its wood appears slightly browner. It is plentiful on the hills near Adelaide, and is known as Peppermint.

On returning to the station, a railway officer informed me that there were only two kinds of trees within five or six miles of Serviceton, viz., Bull Oak and Box; beyond that there were some Mallees. From this it will be seen that by the merest accident I had found both the local species, and neither had been recorded for this locality.

The Acacias noticed between Wirchilleba and Eremeran were:—*A. Oswaldi*, *A. homalophylla*, *A. calamifolia*, *A. doratoxylon*, *A. aneura*, *A. colletioides*, *A. dealbata* (green variety), *A. decora*, and *A. excelsa*.

Acacia calamifolia, *A. aneura*, *A. excelsa*, and *A. colletioides* were not seen east of Eremeran, so that probably this is about their eastern limit between the Bogan and Lachlan.

For about 50 miles *A. aneura* (Mulga) has not been plentiful, occurring only in patches and becoming less, thereby indicating that the species has been spreading south-easterly from its stronghold in the north-west. Its distribution, however, is probably nearly over, as, being such an excellent fodder tree for sheep, the young plants are eaten off at an early stage. In the absence of other timber, Mulga is now one of the principal trees burnt for charcoal near Cobar.

Acacia excelsa was represented by a cluster of six trees on the south side of the road, opposite a dam near the western boundary of Eremeran Holding. The leaves were narrower than usual. A station-hand stated that he knew of no other such trees, and that they had no local name. In the northern districts they are known as Ironwood, but near here that name appears to be applied to large trees of *Heterodendron oleæfolium*. Eremeran is probably the most easterly locality for *A. excelsa* south of the Bogan.

The Eucalypts noticed were:—*E. populifolia*, *E. viridis*, *E. rostrata* (on creeks), *E. tereticornis*, var. *dealbata* (Gum), *E. intertexta*, and near Eremeran, *E. Woollsiana* (Box).

On Wirchilleba *E. intertexta* appears to be known chiefly as Yellow Box and Gum, and on Eremeran as Red Box.

Between Eremeran and Mount Tinda, viâ Vermont Hill, there are *Casuarina Luehmanni*, *C. Cambagei*, *Eremophila Mitchelli*, *E. longifolia*, *Heterodendron oleæfolium*, *Sterculia diversifolia*, *Apophyllum anomalum*, *Hakea leucoptera*, *Myoporum deserti*, *Callitris robusta*, *Pittosporum phillyræoides*, *Templetonia* sp., (without flowers), *Geijera parviflora*, *Dodonæa* sp., *Fusanus acuminatus*, *Bertya Cunninghamii*, *Tecoma australis*, *Cassia eremophila*, and *Canthium oleifolium*.

Although this last-mentioned species has a fairly wide distribution, it does not appear to grow in great quantities anywhere, but is found at intervals in small patches, and is one of the plants known as Lemon Bush.

The Acacias noticed hereabouts were:—*A. decora*, *A. dealbata* (green variety), *A. Oswaldi*, *A. hakeoides*, *A. Burkittii*, and *A. homalophylla*.

A. Burkittii was found a little west of where the Eremeran road meets the main road from Nymagee to Condobolin, or close to Vermont Hill. It was not seen afterwards, so that this is probably about its eastern limit, at least south of the Bogan. Until mentioned in Part i. of these Notes this species was not previously recorded for New South Wales. Subsequent papers show its extension from about 40 miles north of Cobar to about 50 miles north-west of Condobolin. In the Nymagee district it is sometimes known as Kangaroo Bush, and Cherrypickera was given me as an aboriginal name, but I had no opportunity of verifying it.

The Eucalypts between Eremeran and Mount Tinda are:—*E. tereticornis*, var. *dealbata* (on granite), *E. populifolia*, *E. intertexta*, *E. Woollsiana*, *E. rostrata* (on creeks only), *E. oleosa*, *E. dumosa* and *E. viridis*.

In coming from Bourke and following the route described in these papers, Vermont Hill was the first place met with in which wheat growing was being carried on to any extent, several settlers here having good areas under crop.

Just south of Vermont Hill are miles of Mallee, extending away south-westerly. The same scrub is met on Palisthan Holding, and again between Mount Hope and Euabalong, quite 50 miles away. I cannot say that it is continuous, but such is probably the case, as it has been met with wherever I have crossed that belt of country. *E. oleosa* and *E. dumosa* predominate throughout.

Mount Tinda is composed of granite and porphyry, and covered chiefly with *Eucalyptus tereticornis*, var. *dealbata*, and *Callitris robusta*. I obtained here some interesting specimens of felspar crystals (orthoclase).

From Mount Tinda to Condobolin is about 40 miles south-easterly. Copper and gold mining are being carried on at different points along the route. Various trees and shrubs passed were:—*Geijera parviflora*, *Pittosporum phillyræoides*, *Heterodendron oleæfolium*, *Apopyhyllum anomalum*, *Callitris robusta* (all the way), *Bossiæa* sp., *Triodia irritans*, *Myoporum deserti*, *Eremophila Mitchelli*, *E. longifolia* (getting scarce), *Hakea leucoptera*, *Bertya Cunninghamii*, *Sterculia diversifolia*, *Lysicarpus eucalyptifolia*, and *Callitris verrucosa*. After passing Mount Nobby, where the formation is porphyry and slate, there were, in addition to many of the former, *Tecoma australis*, *Cassia eremophila*, and *Fusanus acuminatus*. After reaching the Melrose road, at 24 miles from Condobolin, the following were noted:—*Eriostemon difformis*, *Hakea leucoptera*, *Myoporum deserti* (at 19 miles), *Casuarina Cambagei* (18 m.), *C. Luehmanni*, *Hakea leucoptera* (plentiful, 15 m.), *Exocarpus aphylla* (7 m.), *Geijera parviflora*, *Sterculia diversifolia*, *Eremophila Mitchelli* (4 m.), *Casuarina quadrivalvis*, and *Canthium oleifolium*.

The Acacias noticed between Mount Tinda and Condobolin were:—*A. homalophylla*, *A. dealbata* (green variety), *A. Oswaldi*, *A. decora* (chiefly on porphyry), *A. doratoxylon*, and near the Lachlan at Condobolin *A. salicina* (Cooba or Native Willow) and *A. pendula* (Boree or Myall).

The Eucalypts observed were:—*E. populifolia*, *E. oleosa*, *E. dumosa* (as a Mallee scrub with *E. sideroxylon* (Ironbark), along the edge of it), *E. Woollsiana*, *E. tereticornis*, var. *dealbata* (with partially-double operculum, near Mount Nobby), *E. viridis* and *E. intertexta*. After reaching the Melrose Road at 24 miles from Condobolin, the Eucalypts passed were as follows:—*E. populifolia* (all the way), *E. intertexta* (scarce), *E. Woollsiana* (all the way), (21 m.), *E. oleosa* (8 m.), *E. tereticornis*, var. *dealbata*, *E. dumosa* (7 m.), a few trees of *E. intertexta* (6 m.), *E. oleosa* (fairly large), *E. sideroxylon* (4 m.), one tree of *E. intertexta*, and *E. tereticornis*, var. *dealbata*.

Finding *E. sideroxylon* and *E. Woollsiana* growing together between the 3- and 4-mile posts, I searched for the supposed hybrid or Ironbark Box, and succeeded in finding a few trees on the eastern side of the road. None were growing within sight from the road, and had their presence not been suspected, they would have been passed unnoticed. They were in every respect similar to those found north of Nymagee and mentioned in a previous paper (Part ii.) These trees can generally be at once detected by their bark, it being rougher than the Box and smoother than the Ironbark, and usually is somewhat of a yellowish-brown colour, especially towards the upper part of the trunk.

On the Lachlan, close to Condobolin, *Eucalyptus rostrata*, *E. melliodora*, and *E. largiflorens* were noticed.

Just above Condobolin are trees of *E. largiflorens* and *E. Woollsiana* growing together, and undoubtedly a casual observer would class them as the same species. In this particular case the leaves of both are rather pale, and do not present the usual contrast that is to be noticed between these trees. A little inspection, however, soon reveals the distinction in the bark on the branches, those of *E. Woollsiana* being clean, while those of *E. largiflorens* are rough.

The tree of *E. intertexta*, noticed about 3½ miles north of Condobolin, marks the most south-easterly point at which I have found this species.

From the Melrose Road, at 29 miles north-westerly from Condobolin to Bulbodney Creek, near Jumble Plains Homestead, at about 20 miles south-west of Dandaloo on the Bogan, is north-easterly about 40 miles. There is scarcely a house to be seen the whole way, and the general character of the vegetation may be understood from the names of the following trees and shrubs which were noticed. These were :—*Geijera parviflora, Callitris robusta, Eremophila Mitchelli, Heterodendron oleæfolium, Hakea leucoptera* (all these continuing practically the whole way), *Cassia eremophila, Sterculia diversifolia, Dodonæa viscosa*, var. *attenuata, Apophyllum anomalum, Bertya Cunninghamii, Fusanus acuminatus, Exocarpus cupressiformis* (Native Cherry), *E. aphylla, Pittosporum phillyræoides, Myoporum deserti* (37 m. from Dandaloo), *Grevillea floribunda*, R.Br. (a shrub flowering in June), *Melichrus urceolatus*, R.Br., (a shrub with flowers in June), *Eriostemon difformis, Celastrus Cunninghamii, Leptospermum* sp. (Tea-tree), and *Micromyrtus microphylla*, Benth., a little shrub with an abundance of short leaves and small flowers.

A little nearer Dandaloo, towards Albert Waterholes, is *Callitris calcarata*, R.Br., known in various localities as Mountain Pine, Black Pine, and Green Pine. It generally grows on hills, and has black bark and green foliage. Its timber is not much esteemed.

At about 30 miles south-west of Dandaloo, and near this bush track, the White Pine, *Callitris robusta*, has evidently not been much used, as there is a considerable quantity of fine trees.

The Casuarinas noted were :—*C. quadrivalvis, C. Luehmanni*, and *C. Cambagei*, the last two being strongly represented.

The Acacias were *A. doratoxylon, A. dealbata* (green variety), *A. Oswaldi, A. homalophylla, A. decora, A. hakeoides, A. triptera* (Wait-a-while), and *A. pendula*.

Acacia Oswaldi has a very wide range, but at the same time it is never found in great quantities. I have never found it forming scrubs, and usually each tree grows by itself, often the nearest of the same species being several hundred yards away. The stem is generally less than six inches in diameter and very hard, being a favourite for stockwhip handles, and generally useful where toughness is required. The leaves terminate in short spines, which have earned for the tree the unsuitable name of Dead Finish, the inference being that a traveller entering a cluster of these trees would suddenly find his journey finished owing to the resisting nature of these spikes. Even if this species formed scrubs, the leaves are harmless compared with those of many others. It is probable that the name properly belongs to some other tree, and has been applied to this one by mistake. Still I found it used over a very large area. About half-way between Condobolin and Dandaloo it is known by some as Gidgea, its value for stockwhip handles having probably caused it to be confused with the Bourke species of the same name, *A. Cambagei*, which is famous over most parts of the colony among stockmen.

A. pendula was found in one place only, at about 31 miles from Dandaloo, growing on a small patch of black soil among gilgais.

A. triptera was seen near Wilmatha Hill, about 40 miles north of Condobolin, growing with one stem, but spreading to 8 or 10 feet across the top. Its curved, pointed leaves have suggested the name of Wait-a-while, as they decidedly impede locomotion. The species was not found east of this point, and probably does not much exceed it south of the Bogan.

The Eucalypts noted along this road were :—*E. populifolia*, *E. sideroxylon* (in patches), *E. Woollsiana*, *E. tereticornis*, var. *dealbata*, *E. viridis*, *E. intertexta*, *E. melliodora* (Yellow Box), a little of *E. oleosa*, *E. dumosa*, and *E. rostrata*.

E. intertexta ceases at about 35 miles north of Condobolin, and easterly from that point is not seen again, though it extends northerly. In the Bogan and Lachlan country its eastern margin may be approximately fixed by a line joining Mullengudgery and Condobolin. It goes south-westerly into South Australia, as I have seen it at Tintinarra in the Ninety Mile Desert. There it grows as a fairly smooth white-barked tree, with red interlocked wood. The trees are smaller than those in the Cobar and Nymagee districts, though they do not grow as Mallee, and are often known as Desert Gum. In outward appearance it resembles *E. leucoxylon*, F.v.M., which grows with it in the desert, but has a yellowish wood.

The Mallees were not so plentiful in this locality, as they were to the westward, *E. oleosa* and *E. dumosa* not being seen east of Jumble Plains.

E. melliodora was found only at about 34 miles south-west of Dandaloo. Most of the trees had smooth white bark. North of the Lachlan this is the most western locality in which I have found this species when growing away back from the river.

At about 26 miles south-west of Dandaloo *E. sideroxylon* was noticed in considerable quantities, and of better quality than usual.

E. rostrata was growing on Bulbodney Creek. The buds had a short operculum similar to that found on trees at Sandy Creek, south of Nymagee, and mentioned in a previous paper (Part iii.).

The next piece of country to be dealt with extends from Jumble Plains Homestead south-easterly to Trundle, being nearly 50 miles.

Various trees and shrubs noticed were:—*Callitris robusta* (which continues all the way), *Eremophila Mitchelli*, *Apophyllum anomalum*, *Myoporum deserti*, *Dodonæa* sp., *Pittosporum phillyræoides*, *Heterodendron oleæfolium*, *Bertya Cunninghamii*, *Hakea leucoptera*, *Cassia eremophila*, *Fusanus acuminatus* (on Burra Burra Holding), *Tecoma australis*, *Grevillea floribunda*, *Eremophila longifolia*, *Callitris calcarata*, *Melichrus urceolatus*, *Exocarpus cupressiformis* (at Bullock Creek), *Olearia* sp., *Sterculia diversifolia*, *Eriostemon difformis*, *Geijera parviflora*, *Solanum eremophilum* (15 m. from Trundle), *Exocarpus aphylla*, *Eremophila Mitchelli*, *Myoporum deserti*, *Hakea leucoptera*, *Sterculia diversifolia*, *Heterodendron oleæfolium* (12 m.), *Pittosporum phillyræoides*, and a few trees, 20 feet high, of *Santalum lanceolatum*.

The finding of *Santalum lanceolatum* (Blacks' Medicine Tree of South Bourke) at about 10 and 12 miles north-west of Trundle was a matter for surprise, as the species had not been seen along the road travelled since passing Cobar, nor was it afterwards noticed. It may be found, however, between Dandaloo and Trangie.

The formation near the 11-mile post from Trundle, or 23 from Bogan Gate, is Devonian, as proved by fossils found on the road-side.

The Casuarinas passed were :—*C. quadrivalvis*, *C. Cambagei*, and *C. Luehmanni*, the last-named being most plentiful and the first but sparsely represented.

The Acacias seen were :—*A. Oswaldi*, *A. hakeoides*, *A. decora*, *A. dealbata* (green variety), *A. amblygona*, *A. doratoxylon*, *A. conferta*, A. Cunn., *A. homalophylla*, and *A. implexa*. This last-named species comprised about half-a-dozen trees on the western side of a hill composed of a fine-grained granite, and situated a few miles east of Bullock Creek. It has been seen by me at only one point west of this, viz., Nymagee (*vide* Part iii.).

A. conferta was seen here for the first time on the road from Bourke, and was growing in patches, with a height of from 4 to 6 feet.

The Eucalypts noticed between Jumble Plains and Trundle were :—*E. populifolia*, *E. Woollsiana*, *E. sideroxylon*, *E. viridis*, *E. rostrata*, *E. conica*, Deane & Maiden, *E. melliodora*, *E. tereticornis*, var. *dealbata*, and the questionable hybrid, Ironbark Box.

E. rostrata was found on Bullock Creek. The buds were again egg-shaped, with the short operculum similar to those previously found on creeks.

E. melliodora was not plentiful, but increases to the eastward.

On the western boundary of Burra Burra Holding about half-a-dozen trees of the supposed hybrid, Ironbark Box were found. Again, they were growing among *E. sideroxylon* and *E. Woollsiana*.

On Bullock Creek *E. conica* was met with for the first time. This tree is sometimes called Fuzzy Box on account of the rough being somewhat similar to other trees called Apple. Near Cowra it has been pointed out to me as Woolly Butt, while Box and Apple are names applied to it in some instances. Around Gilgandra it is often called Broad-Leaf Box in contrast to *E. Woollsiana*, which in the north-west has generally narrow leaves. The leaves of *E. conica* in the Gilgandra district, north of Dubbo, are not particularly broad, but it often happens that trees are named from comparative qualities which they possess, as well as from extreme forms. The rough bark continues on the branches as well as on the trunk, and the tree has rather a pendulous habit. Its timber, which is not extensively used, is not so pale as that of *E. hemiphloia*, var. *albens*, F.v.M., and generally is more difficult to split. Settlers in the Grenfell and Toogong districts have stated to me that it is one of the most difficult trees they have to clear off the land, as it does not burn readily. This quality also must be taken as comparative, as *E. conica* generally grows among trees which are good burners. Usually it is found on the low land along the rivers and large creeks, and is decidedly rare on the hills.

Many of the above remarks, especially those which refer to bark, drooping habit, timber and habitat, might be applied by some to *E. largiflorens*, but the latter has a redder wood and distinct botanical differences. Although both might be termed River Box, there is this general difference, that *E. conica* grows along the upper portions of the western rivers and *E. largiflorens* along the lower parts, and on the Lachlan the two species just about overlap at Condobolin. *E. conica* is to be found at least on the Castlereagh, Macquarie, Bogan and Lachlan Rivers, as well as over the intervening country where there are valleys. I have never found it so far south as the Murrumbidgee. Nor is it to be seen towards the cold highlands of Orange or Crookwell. I have been unable to fix its western limit on the Lachlan, but have seen it near Condobolin, and I think near Euabalong some years ago.

E. viridis was last noticed on the Burra Burra Holding, which is about its most eastern locality south-west of the Bogan. It occurs to the west and north-west of Dubbo, but is very rare to the east of a line joining Dubbo, Bogan Gate and Temora. Over the Macquarie and Lachlan country it is the most eastern of all the Mallees, and in approaching its habitat its presence is often indicated by the fact that the straight tough stems of these little trees may be seen on the carriers' wagons, where they are used as "twitch sticks" to tighten the ropes which fasten the loads.

Parkes is slightly over 30 miles south-easterly from Trundle, and between these towns the following trees and shrubs were noticed:—*Callitris robusta* (practically all the way), *Apophyllum anomalum*, *Casuarina Luehmanni* (plentiful), *Heterodendron oleæfolium*, *Myoporum deserti*, *Hakea leucoptera*, *Geijera parviflora*, *Casuarina Cambagei*, *Exocarpus aphylla*, *Dodonæa viscosa*, *Bertya Cunninghamii*, *Olearia* sp., (22 m. from Parkes), *Exocarpus cupressiformis* (21 m.), *Leptospermum* sp., *Grevillea floribunda*, *Melichrus urceolatus*, *Hibbertia sericea*, Benth., *Eremophila Mitchelli*, *Cassia* sp., *Callitris calcarata* (18 m.), *Eremophila longifolia* (15 m.), *Fusanus acuminatus*, *Casuarina Luehmanni* (11 m.), *Sterculia diversifolia* (5 m.), *Templetonia* sp. (without flowers), *Geijera parviflora* (2 m.), and *Eremophila Mitchelli*.

The Acacias noticed along the road were:—*A. homalophylla*, *A. Oswaldi*, *A. decora*, *A. hakeoides*, *A. dealbata* (green variety), *A. doratoxylon* (15 m.), *A. spectabilis*, A. Cunn., (the first seen; 10 m.), *A. pendula* (5 m.), *A. decora* (2 m.), and *A. Oswaldi*.

The patch of Myall between the 9- and 10-mile posts north-westerly from Parkes marks its most eastern locality in the Parkes district. Formerly it grew on a plain about half-way between Parkes and Forbes, but there is scarcely a living tree to be found there now.

At about 15 miles from Parkes, towards Trundle, there are a few trees of an Acacia which appears to be either *A. implexa*, or *A. melanoxylon*, but in the absence of both flowers and pods the species was not identified. I have never seen the latter so far west as this, and the former only on two occasions already mentioned. Either species seems out of place in the far west.

The Eucalypts between Trundle and Parkes were represented by *E. populifolia*, *E. Woollsiana*, *E. melliodora*, *E. sideroxylon* (24 m.), *E. conica* (23 m.), *E. tereticornis* (21 m.), *E. tereticornis*, var. *dealbata*, *E. sideroxylon* (one tree with red flowers in June; 15 m.), *E. hemiphloia* var. *albens* (White Box), *E. conica* (10 m.), *E. melliodora* (7 m.), *E. Woollsiana*, *E. populifolia* (2 m.), *E. Woollsiana* and *E. melliodora*.

The trees of *E. tereticornis* near the 22-mile post were the first typical ones seen in coming from Bourke. From this point easterly the species is not uncommon on the lowlands, the variety *dealbata* taking the hills (*vide* Part ii.).

E. populifolia has been seen practically all the way, but it ceases about six miles westerly from Parkes, and easterly of a line joining Parkes, Forbes and Temora the species is not found. Nor have I seen it east of a line joining Parkes and Dubbo.

Towards Parkes the leaves of *E. Woollsiana* are in many cases much broader than in the Nymagee district.

E. hemiphloia, var. *albens*, is the common White Box of the western slopes. It seems to prefer a climate between the extreme heat of the plains and the extreme cold of the mountains, so that its distribution, though extending very far north and south, is much more limited east and west. It practically extends all along the western side of the Great Dividing Range, but rarely is to be found on the higher parts of it excepting towards the north. It comes eastward among the mountains by following the valleys of such rivers as the Macquarie, Turon, Lachlan and Abercrombie, but only crossing from one to the other where the intervening hills are low. This is another of those western forms that comes across the Liverpool Range on to the coastal area near Scone, and is plentiful on the upper Hunter. As previously mentioned (Part iii.), its flowers are rich in honey, and on Moonan Brook (a tributary of the Hunter), the bees during the autumn obtain their supply chiefly from this species. As a line from Dubbo through Forbes to Temora roughly marks the eastern limit of *E. populifolia*, so a line from about Narromine through Temora to Corowa on the Murray approximately denotes the western margin of *E. hemiphloia*, var. *albens*. In its most western localities it is generally found on the highest land, and in this way seems to push out further than would be the case if the country were all plains. In many cases towards its western or lower area it may be found growing in company with *E. Woollsiana*, and the two trees resemble each other considerably through both having bark of two colours, a grey box-bark on the trunk and clean whitish limbs, the latter colour very often coming down in both species on the upper part of the trunk. In outward appearance the resemblance ceases here, as *E. hemiphloia*, var. *albens*, has much larger fruits and broader leaves, which are generally pale and covered with a white powder, giving the trees in many cases a silvery appearance. *E. Woollsiana*, on the other hand, has dark green leaves, and in contrast to *E. hemiphloia*, var. *albens*, the White Box, is often called Black Box. On the western slopes of the Great Dividing Range, approximately from Mudgee southward into Victoria *E. hemiphloia*, var. *albens*, is seldom found growing at an altitude exceeding 2,000 feet above sea-level, and occupies only that part of the elevated country which is not subject to regular heavy falls of snow; or its eastern margin indicates the western edge of our regular mountain snowstorms. A few miles east of that line snow may be expected nearly every winter, while a few miles west of it some winters may pass without any snow falling there. In July, 1900, a severe fall extended many miles into the White Box country, and being most unusual, the branches of the trees were broken by the weight of the snow much more than is the case with those species growing in higher localities where heavy falls are regular. In going from Sydney across the Blue Mountains, the western plants proper need not be expected till trees of *E. hemiphloia*, var. *albens*, are found; after that there is a possibility of a distinct change in the flora at any time, so that this Eucalypt occupies an interesting position between the mountain and the plain. In geological formation it seems to slightly prefer igneous to sedimentary, being common on granite, porphyry and diorite, but when growing on sedimentary, such as Silurian or Devonian, it generally avoids the rocky situations, and grows chiefly on the alluvial formed by the species. The typical *E. hemiphloia*, F.v.M., is more of a coast form, and though common on the Wianamatta Shale and igneous formations, it is less plentiful on the Hawkesbury Sandstone, and altogether is not so strongly represented in this State as the variety *albens*.

In coming from Cobar to Parkes I expected at some point to find *E. melanophloia*, Benth., the Silver-Topped Ironbark, but failed to do so. Its most southern locality, therefore, so far as I know, is around Narromine. Neither was *E. siderophloia*, F.v.M., seen, but it occurs at a point about 30 miles north of Parkes and 8 miles east of Peak Hill, which is probably its most southern locality in the western district.

The total number of Eucalypts noticed between Mount Hope and Parkes was fifteen, viz.:—*E. populifolia*, *E. intertexta*, *E. oleosa*, *E. dumosa*, *E. viridis*, *E. tereticornis* (scarce), *E. tereticornis*, var. *dealbata*, *E. Woollsiana*, *E. rostrata* (only on creeks and the Lachlan), *E. melliodora*, *E. conica* (only in the eastern part), *E. largiflorens* (on the Lachlan only), *E. sideroxylon*, *E. hemiphloia*, var. *albens* (only close to Parkes), and the Ironbark Box.

The Acacias were represented by *A. homalophylla*, *A. pendula* (not plentiful), *A. decora*, *A. hakeoides*, *A. dealbata* (green variety), *A. colletioides*, *A. triptera*, *A. aneura* (in the western half only), *A. excelsa* (scarce), *A. Oswaldi*, *A. doratoxylon*, *A. Burkittii* (in the western half only), *A. calamifolia* (in the western half only), *A. amblygona* (scarce), *A. conferta*, *A. implexa* (scarce), *A. salicina* (on the Lachlan only), and *A. spectabilis* (close to Parkes).

The Casuarinas were:—*C. quadrivalvis*, *C. Luehmanni*, and *C. Cambagei*.

EXPLANATION OF PLATES.

Plate xx.

Fig. 1.—*Capparis Mitchelli*, Lindl. (Wild Orange), Cobar, N.S.W.
Fig. 2.—*Flindersia maculosa*, F.v.M. (Leopard-tree), Bourke, N.S.W.

Plate xxi.

Fig. 3.—*Eucalyptus microtheca*, F.v.M. (Coolabah), Bourke, N.S.W.
Fig. 4.—*Atalaya hemiglauca*, F.v.M. (Whitewood), Bourke, N.S.W.

CONTRIBUTIONS TO A KNOWLEDGE OF AUSTRALIAN ENTOZOA.

No. i.—On a new species of *Distomum* from the Platypus.

By S. J. Johnston, B.A., Economic Zoologist,
Technological Museum, Sydney.

(Plate xxii..)

The specimens (about fifty in number) forming the material for this paper were collected by Mr. J. P. Hill, B.Sc., F.L.S., Demonstrator of Biology in the University of Sydney, and by Mr. A. M. Lea. Mr. Hill's collection was obtained at the Tumbledown Creek, Williams River, and at the Manning River; Mr. Lea's at Little River, Dalmorton. Both collections were handed over to me by Mr. Hill, whom I have to thank, also, for a number of valuable preparations of the animal. The parasite was found in the stomach, duodenum and the anterior part of the small intestine of the Platypus (*Ornithorhynchus anatinus*, Shaw). After careful comparison with the published descriptions and figures available to me,[*] I have come to the conclusion that it is a new species.

Distomum ornithorhynchi, sp.n.

General shape of body elongate, tapering at both ends, the posterior end narrowing more gradually than the anterior; no distinct neck; body somewhat flattened dorsiventrally, the sides being rounded. The longest specimen measured alive was 9 mm. long, the average length of preserved specimens being about 8 mm., the breadth from 1 to 1·2 mm. In very many the body is flexed ventrally. Colour when alive light salmon-pink. Cuticle produced into a number of small, conical papillæ, slightly recurved; very numerous on the anterior part of the body, where they are sharp-pointed, less numerous towards the middle, becoming very few and blunt on the posterior third; length of papillæ lying about the anterior end about 0·013 mm.; the length of the base 0·015 mm.* Suckers comparatively large and orbicular, the longitudinal diameter slightly exceeding the transverse. Oral sucker subterminal; ventral placed far forward, not much behind the oral, the distance between them being about one-half the longitudinal diameter of the oral sucker. Both suckers sessile, each possessing a fairly deep cavity; devoid of hooks and lobes of any kind. Average diameters of the oral sucker of the specimens measured—longitudinal 0·68 mm., transverse 0·59 mm.; of the ventral, longitudinal 1·02 and transverse 0·85 mm. Common genital aperture situated on ventral surface to the left of the median plane, on a level with the pharynx about its middle. Excretory pore situated at the extreme posterior end.

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[*] C. M. Diesing, Systema Helminthum; P. J. Van Beneden, Mémoire sur les Vers Intestinaux; Bronn's Klass. u. Ord.; E. Linton, "Notes on Trematode Parasites of Fishes," Proc. U.S. National Museum, Vol. xx.; Cobbold's Entozoa; Neumann's Parasites of Domesticated Animals; G. S. West, on *D. philodryadum*.

Cuticle comparatively thick; the integument of the animal has a longitudinally striped appearance owing to the bands of longitudinal muscle underlying it; the stripes run from the ventral sucker to the extreme posterior extremity.

Alimentary canal simple. Mouth situated at the base of the oral sucker, leading into a muscular pharynx. Pharynx protrusible, being found in a number of specimens everted into the cavity of the oral sucker (figs. 3-4). Œsophagus, into which the pharynx leads, so short as to be almost non-existent, immediately dividing into the two branches of the intestine, which are simple, unbranched and fairly straight, running almost to the extreme posterior end of the animal, the blind, sac-like extremity being about 0·2 mm. from the end of the body. Excretory system only visible in sections, consisting of a very short main trunk opening at the pore, which divides into several principal branches, the ramifications of which become obscured in preserved specimens.

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* In the figure (fig. 1) the papillæ are somewhat exaggerated in size.

The testes are two densely staining, elongated bodies, with a bulbous, lobed, almost moniliform outline, situated just posterior to the ovary and shell-gland, and lying one behind the other, stretching obliquely across the median line. In a body length divided into fourths they occupy the third quarter. The vasa deferentia unite before reaching the ventral sucker, and the common duct, running behind and slightly to the left of that sucker, on a level with its anterior part, expands to form a conspicuous vesicula seminalis, which, in its anterior part, twisting on itself, leads into an ejaculatory duct, and through the cirrus to the genital opening. The ovary is a conspicuous, subglobular, fairly solid body, situated about the middle of the animal. From it the oviduct runs back for a short distance; then, bending through 180° it runs forwards almost parallel to its former course, and on a level with the anterior edge of the ovary it expands into the uterus. At the bend it receives the united duct of the yolk-glands, and a little further forward the duct of the shell-gland opens into it. The uterus extends to the posterior aspect of the ventral sucker in about eight turns or coils, and there ends in the vagina, which, skirting the left side of the ventral sucker and vesicula seminalis, opens into the common genital chamber, opposite the male aperture. The common genital chamber is very small. The uterus of each of the specimens examined was distended with eggs, which are elliptical in shape, the chitinous egg-shells of the preserved specimens being straw-coloured. The eggs of a specimen which was mounted, when fresh, in glycerine measured 0·13 × 0·069 mm. There is little or no appreciable variation in size. The shell-gland is large, and situated behind and to the left of the ovary.

The yolk or vitelline glands consist of a large number of rounded follicles extending from the ventral sucker to the posterior end of the body. From their anterior boundary, as far back as the first testis, they are confined to the lateral aspects of the animal, but from this point to the end of the tail they spread superficially over the dorsal and ventral walls, leaving only a small central space free from their encroachments and occupied by parenchyma alone.

Briefly the characteristic features of the animal by which it may be readily distinguished from other species of the same genus are the globose, solid ovary situated in front of the elongated, somewhat cylindrical, lobulated testes, whose shape might not inaptly be compared to long, knobby potatoes; the very numerous, rounded, follicular vitelline glands extending over a large part of the body-surface; the simple, orbicular character of the suckers, and the markedly anterior position of the ventral sucker; the distribution of the spinous papillæ, and the longitudinally striped appearance of the integument when the surface of the animal is in the optical plane.

As regards its relations to other members of the genus, the simple nature of the intestine, the absence of hooks or lobes from the oral sucker, the almost total obliteration of the œsophagus and the absence of a retractile telescopic tail part, place the species in Dujardin's subgenus *Brachylaimus* (Bronn's Klassen u. Ordnungen, Bd. iv., p. 909).

But it does not show a striking likeness to any particular species, though it resembles some in its external characters, others in respect of the alimentary canal, others again in the form or disposition of the reproductive organs. As regards the character and situation of the suckers, it shows a close resemblance to *D. tornatum*, Rudolphi. The globose, solid ovary resembles that organ in *D. ocreatum*, Molin,* *D. monticellii*, Linton, and *D. grandiporum*, Rudolphi. The character of the suckers, the alimentary canal, and the distribution of the spines over the body are very similar to those of *D. philodryadum*, G. S. West.

The figures for the plate were drawn by my wife.

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* Linton, Notes on Trematodes, Proceedings U.S. Nat. Mus.. Vol. xx., p. 515, etc., etc.

EXPLANATION OF PLATE.

Fig. 1.—View of the whole animal, stained with borax carmine and slightly squeezed out under the cover-glass (× 18).

Fig. 2.—Longitudinal section through the anterior end, showing the common genital chamber, vagina and cirrus. The section is cut somewhat obliquely owing to a bend in the animal (× 18).

Fig. 3.—Transverse section through the middle of the oral sucker, showing the everted pharynx (× 70).

Fig. 4.—Longitudinal section through the anterior end of the animal, showing the everted pharynx (× 18).

All the figures, except the hooks in fig. 1, were outlined under a camera lucida.

Reference letters.

c.g.c., common genital chamber.—*cir.*, cirrus.—*ej.d.*, ejaculatory duct.—*g.p.*, genital aperture.—*int.*, intestine.—*o.s.*, oral sucker.—*ov.*, ovary.—*ovid.*, oviduct.—*ph.*, pharynx.—*s.g.*, shell gland.—t_1 & t_2, testes.—*ut.*, uterus.—*vag.*, vagina.—*v.d.*, vas deferens.—*vit.*, vitelline glands.—*vit.d.*, vitelline duct.—*v.s.*, ventral sucker.—*ves.sem.*, vesicula seminalis.

FURTHER NOTES ON SUPPOSED HYBRIDISATION AMONGST EUCALYPTS (INCLUDING A DESCRIPTION OF A NEW SPECIES).

By H. Deane, M.A., F.L.S., &c., and J. H. Maiden, F.L.S., &c.

The question of hybridisation amongst Eucalypts has been a moot one for many years. Recently we called attention to the subject (these Proceedings, 1900, xxv., 111), and Mr. R. H. Cambage has a further note (*ibid.*, xxv., 716). We would point out that in supposed cases of hybridism an Ironbark has hitherto been generally looked upon as one of the parents.

We again invite attention to the trees distinguished in a former paper as *b*, *c*, *d*, *e*, *f* (these Proceedings, 1900, xxv., pp. 111-112).

We amend our reference to *b* by stating that an extended series of specimens shows that its anthers do not really differ from those of *c*, *d*, *e* and *f*. We look upon all these trees, viz., *b*, *c*, *d*, *e*, *f*, as belonging to one species, all the differences noted being referable to local variation.

It has already been shown that this tree possesses affinities both to *E. siderophloia* and *hemiphloia;* some botanists may look upon it as a variety of either species. To our mind it occupies a position so intermediate between these two species that we have from time to time provisionally called it *E. siderophloia*, var. *hemiphloia*, and *E. hemiphloia*, var. *siderophloia;* but both these descriptive names have the objection, in our view, of committing one to a definite opinion as to the parentage of the species. As it seems sufficiently constant in its characters over a large area, we think the wisest course is to give it a definite name, and therefore propose to call it *E. Boormani*, after John Luke Boorman, a collector of the Botanic Gardens, who, in regard to this and other species, has prosecuted enquiries in an intelligent and painstaking manner.

We are indebted to specimens of a species from Concord from Mr. R. H. Cambage, and the examination of the specimens from the point of view of hybridisation is so instructive that we relate it in detail. Mr. Cambage stated that his tree was growing among *E. paniculata*, Sm., (another of the Ironbarks), with *E. hemiphloia* near. He added :—"The fruits look like those of *E. paniculata*, but the bark is not that of an Ironbark. The bark is as smooth as that of *E. hemiphloia*, and continues right up among the branches." Reference to the herbarium of the late Dr. Woolls showed that he had, many years previously, obtained specimens from the same locality, and following is a copy of his label :—"*E. paniculata*, Bastard Ironbark. Bark something like Woolly Butt or Box." The immature fruits have rims which remind one of those of *E. melliodora*, and, while seized of its affinities to *E. paniculata*, *E. siderophloia*, and *E. hemiphloia*, there was certainly evidence to look upon it as an aberrant form of *E. melliodora*, and also of *Bosistoana*, an affinity which (as regards the latter species) had already been arrived at by Mueller (though in a different way), as regards the Cabramatta specimens (see p. 343). The fruits are a shade smaller than those of some specimens in our possession, and we have from time to time looked upon the tree as a possible hybrid between *E. paniculata* and *E. hemiphloia*, and *E. paniculata* and *E. melliodora* respectively. We have examined the trees referred to by Dr. Woolls and Mr. Cambage, and are of opinion that, while they may be properly described as "Black Box" and "Ironbark Box," there are certain points of difference between them and the Cabramatta trees which make us hesitate in referring them to the same species. The foliage and fruits are less coarse than those of Cabramatta, and this circumstance, coupled with the fact that the trees grow amongst *E. paniculata*, may cause some observers who may be inclined to look upon the Concord trees as hybrids to consider that *E. paniculata* is one of the parents. Bearing in mind that cases of hybridisation amongst Eucalypts usually break down under fuller examination, we hesitate to believe that we have a case of hybridisation here, and will revert to the subject at some future time.

With these somewhat lengthy prefatory remarks on points connected with supposed hybridism amongst Eucalypts, we proceed to give a botanical description of *E. Boormani*, already referred to.

The name "Black Box" seems to be most generally in use for this species; the even better name of Ironbark Box (which certainly indicates its affinities) is nearly as frequently in use. At Lue it is also called "She Ironbark," its difference from the ordinary Ironbarks being thus recognised.

Bark dark in colour, often very dark grey and even black. In texture scaly, sometimes hard scaly, and even in parts nearly as rugged as an Ironbark, but never as soft as a Box. The rough bark extends to the small branches.

Timber pale reddish-brown in colour, hard and durable, and, according to the testimony of many observers, while of an Ironbark character, even superior to the Ironbarks of the district in which it grows. It is much sought after by wheelwrights for spokes and shafts, and the special demand for it is causing it to be scarce in readily accessible localities.

It is looked upon as a grand pile timber, and the bushmen say they get a bigger price for it than for any others. The posts of the small bush-house in the Botanic Gardens, Sydney, are of this timber, and Mr. Vallins, of Bankstown, who erected it, looks upon it as the most valuable timber in his district.

The only unfavourable report of the timber we have seen is by the late Mr. T. Shepherd, who, while praising its good qualities, speaks of it as a bad burning wood—perhaps really an advantage, as a timber of this character is really too valuable for use as fuel.

Sucker leaves broad and coarse, nearly orbicular, but early becoming lanceolate.

Mature leaves ovate-lanceolate to lanceolate, usually three to six inches long, and over one inch in breadth; veins fine and rather spreading, the intramarginal vein usually quite close to the edge. Texture of the leaf coriaceous and tough, like that of *E. siderophloia*.

Buds.—The buds and stamens appear to us not to differ from those of *E. siderophloia*.

Operculum conical, like that of *E. siderophloia*, but we have not observed the operculum much to exceed the calyx, which is very commonly the case in *E. siderophloia*, especially in var. *rostrata*.

Fruits nearly semiovate, often slightly angular, usually presenting a good deal of resemblance to those of *E. siderophloia*, but the valves (which usually number four, and sometimes five) scarcely exserted. About three to four lines in diameter, and not contracting at the orifice. Sometimes so subcylindrical in shape as to exhibit considerable resemblance to those of typical *E. hemiphloia*, F.v.M.

Range.—Bankstown and Cabramatta districts, thence across country to Penrith. It has also been found at Lue on the Mudgee line.

E. Boormani seems to have its closest affinity to *E. drepanophylla*. Further investigations may even cause it to be looked upon as a southern form of the Queensland species; but the latter is always described as an Ironbark, and the fragments of the type that we have hitherto had the opportunity of seeing present differences in the fruit and leaves which make us feel that the interests of science will best be served in giving the former a name.

E. Boormani, when young, has the flattish bark often seen in young *E. siderophloia*. The foliage, inflorescence and fruits show obvious resemblance to that species, while its resemblances to *E. hemiphloia* have in our former paper (xxv., 111-2) and in this been dwelt upon.

E. Boormani has undoubted affinity to our *E. affinis*, particularly in the timber and bark. At Lue they are both called Black Box, and, as far as specimens in our possession go, we cannot separate the trees, either in timber or bark; the leaves also are much alike in texture and venation, but the fruits are very as an Ironbark-Box hybrid, its parents being *E. sideroxylon* and *E. hemiphloia*, var. *albens*.

The species has undoubted affinities with *E. Bosistoana*. The late Baron von Mueller recognised this by confusing the two species; or, to put it in another way, by including the Ironbark Box with *Bosistoana* (see the original description, and our note, these Proceedings, xxv., 112). They can, however, be readily distinguished by the rough branches of *E. Boormani*, while those of *E. Bosistoana* are smooth, like the Boxes (*E. hemiphloia*, &c.). At the same time it must be noted that the rough bark on the butt of *E. Bosistoana* often displays considerable similarity to that of *E. Boormani*.

A REVISED CENSUS OF THE MARINE MOLLUSCA OF TASMANIA.

By Professor Ralph Tate and W. L. May.

(Plates xxiii.-xxvii.)

CONTENTS.

i.—Introduction.
ii.—A Sketch of the History of Marine Conchology in Tasmania.
iii.—Systematic List of Species.
iv.—Catalogue of Synonyms applied to Tasmanian Species with the Corresponding Names adopted.
  (1). *Cephalopoda.*
  (2). *Gasteropoda.*
  (3). *Lamellibranchiata.*
  (4). *Palliobranchiata.*
v.—Critical Remarks on some Species and Diagnoses of New Species.

i.—Introduction.

Until 1878, the date of publication of the Rev. Tenison-Woods's "Census," (Proceedings Royal Society of Tasmania for 1877), nothing whatever had been done towards an enumeration of the Mollusca of Tasmanian waters. In that Census, which is the basis of the present essay, the author collated all the species which had been attributed to Tasmania and included a very large number of new species diagnosed by him in earlier communications to the same Society. Messrs. Petterd and Beddome at later dates separately contributed descriptions of new Tasmanian Mollusca. All the aforesaid new species remain unfigured, except a few which were very indifferently illustrated in Tryon's "Manual of Conchology."

Editorial Note.—Proofs of pages 1-64 of this paper were forwarded to Prof. Tate during the last week of August and the first week of September; but in consequence of his illness, which terminated fatally on 20th September, only pages 1-24 were revised and returned by him. Under these circumstances the Editor acknowledges valuable assistance in seeing the Revised Census through the press, received from Mr. C. Hedley.

It seems desirable to point out that the Authors in a number of cases, but not invariably, have adopted the somewhat unusual practice of quoting Journals by the dates of publication without reference to those which form part of the titles. Thus "P.R.S.Tasm. 1877, p. 113" stands for P.R.S.Tasm., 1876, p. 113 [1877]; and (p. 392)

The want of good illustrations of the species diagnosed by the the three authors above-named, has made it almost impossible to bring the constituents of the Tasmanian molluscan fauna into correlation with those of adjacent provincial areas; consequently, they have, to a large extent, been overlooked by subsequent authors, who, occupying themselves with the adjacent faunas, have imposed different names for the majority of the figured species.

The diagnoses by Tenison-Woods are for the most part ample; he was apt in grasping the dominant characters, and only in a few instances are generic assignments inaccurate. We cannot speak quite so favourably of Mr. Petterd's work, but his species claim recognition. Mr. Beddome's work is valueless by the insufficiency of specific characters and by faulty generic location; but from the circumstance that one of us prepared drawings of his types the task of interpretating his species would have been hopeless.

Since 1878, the senior author of this "Revised Census" has been occupied in an effort to bring these insufficiently known Tasmanian species into an alignment with better known species inhabiting other parts of the Australian coast, being aided by the gifts of cotypes from the Revs. Tenison-Woods and H. D. Atkinson, Messrs. Petterd and Legrand, besides having had the privilege of the study of other critical species in the collections of Messrs. Petterd. Simson, Beddome, Harrisson and the Rev. T. Hull.

That the species-names of the shells forwarded to Tryon were in some instances wrong has been made evident, which indicates that the Tasmanian collectors at that time were not agreed in the interpretation of Woods's species; only in a few instances has Tryon indicated the source of his materials.

The junior author of this essay has especially studied the type-specimens or reputed types, of many which are in the Hobart Museum, and is thus enabled to establish on a good foundation the authorities for the specific names.

Wherever possible we shall illustrate all the species which remain unfigured; and in this connection we acknowledge our indebtedness to Mr. Charles Hedley for the figures in the text of type-specimens contained in the collections of Miss Lodder and the Rev. H. D. Atkinson. The five plates are reproduced from drawings by Mr. W. L. May, and include the greater number of Mr. Petterd's types kindly placed at our service by him.

The species of which Tasmanian examples have been studied by us are indicated by an asterisk prefixed to the names; whilst types or cotypes which have been under our examination are indicated by the sign !.

Some of Tenison-Woods's types are in the National Museum, Melbourne, and though Mr. J. H. Gatliff kindly offered to make a study of them, and the Museum authorities were anxious to afford facilities, yet as the whole molluscan collection is stored, as a consequence of removal from the University, it is not possible to have access to them till a year or more.

Some species, as a few recorded by Dunker, without figures, and others by Watson (Challenger Expedition Report) have been assigned to Tasmania; but the type-localities are on the Victorian side of Bass Straits. These we have excluded, excepting those which have on independent evidence a claim to be Tasmanian.

In the geographic references, East Coast embraces from Swan Island to Cape Pillar, and South Coast from Cape Pillar to South Cape.

Some estuarine shells have been omitted from this list, as they have already been elaborated by Mr. W. F. Petterd in "Contributions for a Systematic Catalogue of the Aquatic Shells of Tasmania" (Proc. Roy. Soc. Tasmania for 1888).

Not to overburden the Systematic List with a multitude of synonyms, we have restricted the synonymic names to those that have special reference to Tasmanian Conchology or are pertinent thereto. These are submitted for the most part as the result of the comparison of types or of well-authenticated exemplar specimens. Moreover, we have relegated the reasons for our dissent from the acceptance of certain names and other criticisms, to a separate section of our Essay. Our Catalogue of Synonyms records the names of species assigned to Tasmania other than those in the Systematic List of Species.

It remains to state that Miss Lodder had made arrangements to communicate last year a Revision of the Tasmanian Marine Mollusca to this Society; but on learning that the present authors were preparing a similar contribution, she very graciously withdrew in our favour.

ii.—A SKETCH OF THE HISTORY OF MARINE CONCHOLOGY IN TASMANIA.

It is not certain if any Pre-Lamarckian species, presumably none at all, were described from Tasmanian material, though some few species derived from other sources are admitted as constituents of the Tasmanian fauna.

The first conchological treasures from Tasmania were collected by Péron, the naturalist to the Baudin Expedition, 1801-2 (the narrative of the Expedition, "Voyage aux Terres Australes," was published in 1810). The species were described by Lamarck in his " Animaux sans Vertèbres," (Vol. v., 1818, Vol. vi., 1819, and Vol. vii., 1822) as follows :—

Crassatella Kingicola, Tellina umbonalis, Venus gallinula, Trigonia pectinata, Arca trapezina, A. pistachia, A. squamosa, Saxicava australis and *Fasciolaria coronata* from King Island; *Solen vaginoides, Venus lamellosa, Maleagrina albina* from Canal D'Entrecasteaux; *Crenatula modiolaris, Marginella muscaria, M. formicula, Voluta undulata* and *Phasianella bulimoides* from Maria Island; *Arca semitorta*, Diemen's Land; *Monodonta constricta*, Tasmania (McLeay) ; *Buccinum fasciatum*, Tasmania (McLeay); and *Conus pontificalis*, Parages de la Terre de Diémen (Péron). Some of the above species have not been rediscovered in the assigned localities, and it is presumable from their known distribution that the Tasmanian references are wrong.

The next record is by Quoy and Gaimard, naturalists on board the Astrolabe, Surveying Ship, which visited Hobart. The new species collected there were described and figured in Vol. ii., Part 1 (1832), Vol. ii., part 2 (1833), and Vol. iii. (1835) of the

"Zoologie" of the "Voyage de l' Astrolabe"; they are as follows:—*Siphonaria Diemenensis*, *Littorina Diemenensis*, *Cerithium Diemenense*, *Trochus constrictus*, *T. nanus*, *T. auratus*, *Chiton glaucus*, *Venus nitida*, *Venerupis brevis*, *V. Diemenensis*. As these authors collected also at Port Western and Jervis Bay, describing from those places many species, their descriptive work should have a high value to Tasmanian conchologists.

Philippi in "Abbild. Conch." (Vol. i.), figured *Venus placida* n.sp., and *Cytherea planatella*, Lamarck, and (Vol. iii.) *Littorina Diemenensis*, Q. & G. (1844-47), but did not indicate the source of his material.

Swainson, who had obtained a high reputation as a systematic conchologist as well as a descriptive author, came to Tasmania as an official in the Civil Service of the Colony, and during his stay contributed two papers on Tasmanian Mollusca to the Proceedings of the Royal Society of Tasmania for 1854.

Mr. Ronald Gunn, Mr. W. Legrand and Dr. Milligan forwarded species to the British Museum, London, which were dealt with by Reeve, Deshayes, Sowerby and Hanley in their respective monographs, and also by Adams and Angas.

A long interval then intervened till the Rev. Tenison-Woods took up a temporary residence in Tasmania, and among other natural history work communicated the following papers* dealing with Tasmanian Conchology:—

New Tasmanian Shells. Proc. R. Soc. Tasmania, 1876; 2nd Series, *loc. cit.*, 1877.

Some New Marine Mollusca. Proc. R. Soc. Victoria, xiv., 1877.

On some Tasmanian *Patellidae*. Proc. R. Soc. Tasm., 1877.

On some Australian *Littorinidae*. Proc. Linn. Soc. N.S. Wales, Vol. iii., 1878.

Census, with Brief Descriptions, of the Marine Shells of Tasmania and the adjacent Islands. Proc. R. Soc. Tasm., 1878.

Some New Tasmanian Shells. Proc. R. Soc. Tasm., pp. 32-40, 1879.

New Marine Mollusca. Proc. R. Soc. Vict., xvii., 1881.

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[*] Concerning the dates in these references, see footnote p. 344.

Since 1878, the largest contributor in descriptive work is Mr. W. F. Petterd. In the Journal of Conchology (Vol. ii., 1879), he offered criticisms on twelve species diagnosed by Tenison-Woods, and described seven new ones; and in the same publication in 1884, communicated descriptions of thirty-seven alleged new species. In the Proc. R. Soc. Tasmania for 1886 he described five new species.

The late Mr. Beddome described "New Marine Shells of Tasmania" in Proc. R. Soc. Tasm., 1882 and 1883.

Mr. John Brazier contributed to Proc. R. Soc. Tasm., 1876, synonyms of some Tasmanian Shells; and has elsewhere indicated a few others. Professor Tate and Mr. Charles Hedley have incidentally described species from Tasmanian material, also recognising the extra-limital distribution of many species.

The "Census," by Tenison-Woods, is based largely on the collections made by the Rev. H. D. Atkinson, Messrs. W. F. Petterd, W. Legrand and Augustus Simson. Some of the type-specimens are in the Hobart Museum, but the majority of them are retained by the collectors. After the date of the publication of the Census, the late Mr. Beddome became an active collector; he acquired the collection of Mr. Legrand, and on his death the united collection passed into the hands of Colonel Beddome in London. Mr. Harrisson also did good work; his collection became the property of Mr. W. L. May. Miss. Lodder's collection furnished several additional species to the "Census" list, which were described by Mr. Petterd, the types remaining in her possession. The Rev. T. Hull is another collector, whose cabinet has been utilised by us. Considerable additions to the King Island list, including a few species new for Tasmania, have been made from several parcels of shell-material received by Mr. J. F. Mulder of Geelong, which were determined by one of us.

There cannot be a doubt that among the earlier collections there were aliens to the fauna arising from error in the locality name, possibly, some by confusion of "Ile de Diemen" with Terre de Diemen, which is in N. W. Australia. Hence, *Arca semitorta* crept an entry into the Tasmanian list.

Another source of error is the accidental introduction of exotic species by traders to the Islands of the Flinders Group. Of the eleven species received by the Rev. Tenison-Woods from Mr. Ronald Gunn, five of them attributed to the North Coast are represented by unicums and have not been rediscovered; we consider them to have been introduced.

The issue to us (August 1st, 1900), at the last moment of resigning this manuscript to the Society, of a paper entitled "A List of Tasmanian Shells in the Tasmanian Museum Collection, with the names of many Species that are not yet represented therein, by M. Lodder" (Proc. R. Soc. Tasmania, issued June, 1900), comes rather late to permit of an exact revision of the claims of some species to inclusion in the Tasmanian list; certainly the majority of these are included on very uncertain evidence as regards their Tasmanian occurrence. Doubtlessly, many of the Victorian species may yet be found on the northern coast, which has not been so thoroughly explored as other parts.

The species quoted by Miss Lodder as forming part of the collection in the Hobart Museum have been re-examined, with the result that our interpretations remain unaltered.

Messrs. Petterd and May have intimated that they will donate their types to the Hobart Museum.

iii.—SYSTEMATIC LIST OF SPECIES.

Class CEPHALOPODA.

Family ARGONAUTIDÆ.

Genus ARGONAUTA, Linné, 1756.

*A NODOSA, Solander, 1786; Sowerby, Thes. Conch., t. 257, f. 3. Census; Aust. Mus., Sydney; East and South Coasts, *W. L. May*.

Family OCTOPODIDÆ.

Genus OCTOPUS, Lamarck, 1799.

O. PICTUS, Brock, 1882; Hoyle, Challenger Zool., xvi., 1886. Tasmania (Aust. Mus., *teste* J. Brazier).

Family SEPIOLIDÆ.

Genus Iniotheuthis, Verrill, 1881.

I. **Tasmanica**, Pfeiffer (*Sepiola*). Ceph. Hamburg Mus., p. 6, t. 7, 1884 (type).

Family ONYCHOTEUTHIDÆ.

Genus Onychoteuthis, Lichtenstein, 1818.

*O. **rutilus**, Gould, Moll. Wilkes' Exped., f. 595, 1852. (Coll. W. L. May).

Family SEPIIDÆ.

Genus Sepia, Linné, 1766.

*S. **Capensis**, D'Orbigny, Céph Acét., t. 7, f. 1-3, 1836. North Coast, *Miss Lodder* (Hobart Mus. !).

*S. **mestus**, Gray, Brit. Mus. Cat., p. 108, 1849. North Coast, *Miss Lodder* (Hobart Mus. !).

*S. **elongata**, D'Orbigny & Férussac, Moll. Viv., t. 13, f. 7 and 9. North Coast, *Miss Lodder* (Hobart Mus. !).

S. australis, D'Orbigny; Challenger Zool., t. 7, f. 4. *Miss Lodder* (Hobart Mus.).

Family SPIRULIDÆ.

Genus Spirula, Lamarck, 1801.

*S. australis, Bruguière, Encyc. Méthod., t. 465, f. 15. Census, rather uncommon; King Island, *R. Tate*; Frederick Henry and Storm Bays, *W. L. May*.

Class GASTEROPODA.

Subclass PROSOBRANCHIATA.

Family MURICIDÆ.

Genus Typhis, Montfort, 1810.

*T. arcuatus, Hinds, P.Z.S., 1843, p. 19; Reeve, Conch. Icon., f. 10, 1874.
Long Bay, Bruni Id., *Ten.-Woods*; D'Entrecasteaux Channel in deep water, *W. L. May*.

Genus MUREX, Linné, 1758.

Subgenus PTERONOTUS, Swainson, 1840.

*M. TRIFORMIS, Reeve, Conch. Icon., f. 53.
M. zonatus, Ten.-Woods, P.R.S. Tasm., 1877, p. 132.
Somewhat common (Census): N. Coast; E. Coast, rare, *W. L. May*; King Island!

*M. ANGASI, Crosse & Fischer (*Typhis*), Journ. de Conch., xi., t. 1, f. 2, 1863.
Long Bay (Census); Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May.*

Subgenus OCINEBRA, Leach, 1847.

*M. BRAZIERI, Angas, P.Z.S., 1877, p. 171, t. 26, f. 3.
Trophon tumida, Petterd, Journ. Conch., 1884, p. 141.
N. W. Coast (type of *T. tumida*!).

Subgenus PHYLLONOTUS, Swainson, 1840.

*M. UMBILICATUS, Ten.-Woods (*Trophon*), P.R.S.Tasm., 1876, p. 135; *M. umbilicatus*, Verco, T.R.S. S. Aust., 1896, p. 231, t. 7, f. 4 a-c.; *Urosalpinx umbilicatus*, Tryon, Man. Conch., ii., p. 155.
Type; N. and E. Coasts; King Island!.

*M. LAMINATUS, Petterd (*Trophon*), Journ. Conch., 1884, p. 136. **(Pl. xxiii., fig. 3).***
Tamar Heads (type)!

Genus TROPHON, Montfort, 1810.

*T. PETTERDI, Crosse, Journ. de Conch., x., 1870, and xi., t. 12, f. 2, 1871.
T. clathratus, Ten.-Woods, P.R.S.Tasm., 1876, p. 135.
Abundant (Census): general, *W. L. May.*

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* This and similar references in black type refer to the illustrations accompanying this Revised Census.

*T. **BRAZIERI**, Ten.-Woods, P.R.S. Tasm., 1876, p. 136; Hedley, P.L.S.N.S.W., 1900, xxv., p. 726, f. 23.

Siphonalia castanea, Ten.-Woods, *op. cit.*, 1877, p. 139 (much worn and dead).

Long Bay (type); Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May.*

*T. **GOLDSTEINI**, Ten.-Woods, P.R.S.Tasm., 1876, p. 136; Verco, T.R.S.S.Aust., xix., p. 97, t. 1, f. 4, 4a, 5.

Long Bay (type); D'Entrecasteaux Channel off Pilot Station, *W. L. May.*

*T. **HANLEYI**, Angas, P.Z.S., 1867, p. 110, t. 13, f. 1.

T. Assisi, Ten.-Woods, P.R.S.Tasm., 1877, p. 132; Verco, T.R.S. S.Aust., 1895, p. 98, t. 3, f. 2 (radula).

Urosalpinx Assisi, Tryon, Man. Conch., ii., p. 155.

Var. *squamossima* (an elate form), Ten.-Woods, *op. cit.*, 1879.

North Coast (type).

*T. **PAIVIÆ**, Crosse & Fischer, Journ. de Conch., xii., t. 11, f. 7, 1864.

T. australis, Ten.-Woods, P.R.S. Tasm., 1876, p. 136.

Long Bay (type of *T. australis*); general, *W. L. May.*

Genus PURPURA, Bruguière, 1789.

*P. **BAILEYANA**, Ten.-Woods, T.R.S. Vict. xvii., p. 80, f. 1-2, 1881.

The Leven, N. Coast (*Miss Lodder* !); Tamar Heads, *Mrs. Eddie*; (type in Coll. Tate).

*P. **SUCCINCTA**, Martyn, 1784; Reeve, Conch. Icon. f. 23. (Census).

*Var. *textiliosa*, Lamarck, 1822; Quoy & Gaimard, Voy. Astrolabe, t. 37, f. 1.

Very common (Census); King Island, *R. Tate.*

Genus AGNEWIA, Ten.-Woods, 1878.

Adamsia, Dunker, 1860, nom. præoc.

*A. **TRITONIFORMIS**, Blainville (*Purpura*); Kiener, Mon., t. 8, f. 18.

Adamsia typica, Dunker, P.Z S., 1860, p. 421.

Urosalpinx tritoniformis, Tryon, Man. Conch., ii., t. 39, f. 491.
N. Coast, rare (Census); Frederick Henry Bay, common, *W. L. May.*

*A. ADELAIDÆ, Adams & Angas, P.Z.S., 1863, p. 421, t. 37, f. 2.
King Island, *R. Tate*; North Coast, *W. F. Petterd.* !

Genus SISTRUM, Montfort, 1810.

Ricinula, Lamarck, 1812.

*S. ADELAIDENSIS, Crosse & Fischer, Journ. de Conch., 1865, p. 50, t. 2, f. 1.
**Purpura littorinoides*, Ten.-Woods, P.R.S. Tasm., 1876, p. 135.
**P. propinqua*, Ten.-Woods, *op. cit.*, 1877, p. 135. !
**Cominella albolirata*, Ten.-Woods, *op. cit.*, 1879, p. 33. !
Flinders Island, *Ten.-Woods*; general, *W. L. May.*

*S. RETICULATUM, Quoy & Gaimard (*Purpura*), Voy. Astrolabe, ii., t. 38, f. 17-18.
Purpura humilis, Crosse & Fischer, Journ. de Conch., 1865, t. 2, f. 2.
Loc. ? (Census); King Island, *R. Tate*; Frederick Henry Bay, common, *W. L. May.*

Family LAMPUSIIDÆ.

Genus LAMPUSIA, Schumacher, 1817.

Triton, auct. non Linné; *Lotorium*, Montfort.

*L. AUSTRALIS, Lamarck, 1822; Reeve, Conch. Icon., *Triton* No. 12.
East Coast, *Ten.-Woods*; Schouten Island, *W. L. May.*

*L. SUBDISTORTA, Lamarck, 1822; Reeve, Conch. Icon. (*Triton*), t. 1, f. 2.
Common (Census); N. and E. Coasts, common, not found on S. Coast, *W. L. May.*

*L. BASSI, Angas, P.Z.S., 1869, p. 45, t. 2, f. 2.
Triton fraterculus, Dunker, Malak. Blat., 1871, p. 106.
N. and E. Coasts, *W. L. May.*

*L. SPENGLERI, Dillwyn, 1817; Quoy & Gaimard, Voy. Astrolabe, ii., p. 538, t. 40, f. 1-2.

Triton cutaceus, Chemnitz, non Linné.

Loc. ? (Census); very common on S. and E. Coasts, very rare on N. Coast, *W. L. May*.

*L. WATERHOUSEI, Adams & Angas, P.Z.S., 1864, p. 35; Kobelt, Conch. Cab., iii., p. 166, t. 44, f. 5, 1878.

Loc. ? (Census); all round the coast, but uncommon, *W. L. May*.

*L. FUSIFORMIS, Kiener, Monog., xxxvi., t 5, f. 2.

E. Coast, *Ten.-Woods*; near Maria Island, *W. L. May*.

*L. EBURNEA, Reeve, Conch. Icon., f. 69, 1844.

E. Coast, *W. L. May*.

*L. VERRUCOSA, Reeve, Conch. Icon., f. 71, 1844.

King Island, *R. Tate*; Frederick Henry Bay and E. Coast, *W. L. May*.

*L. QUOYI, Reeve, Conch. Icon., f. 93, 1844.

Common [on N. Coast], *Ten.-Woods*; Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May*; King Island. !

*L. NODOCOSTATA, Tate & May, T.R.S. S. Aust., xxiv., p. 90, 1900. (Pl. xxiii., fig. 2).

E. Coast, *W. L. May* !.

Genus COLUBRARIA, Schumacher, 1817.

Epidromus, Mörch, 1852 (apud Klein, 1753).

*C. BEDNALLI, Brazier, P.L.S.N.S.W., 1875, p. 6; Tryon, Man. Conch., iii., t. 85, f. 576 (original).

Pisania Tasmanica, Ten.-Woods, P.R.S.Tasm., 1876, p. 134.

D'Entrecasteaux Channel, rare (type of *P. Tasmanica*); King Island, *R. Tate*; S. and E. Coasts, rare, *W. L. May*.

Genus APOLLO, Montfort, 1810.

Argobuccinum, Klein, 1753 (preLinnean).

*A. LEUCOSTOMUS, Lamarck (*Ranella*), 1822.

Triton leucostomum, Quoy & Gaimard, Voy. Astrolabe, ii., p. 546, t. 40, f. 3-5.

Common (Census); S. & E. Coasts, *W. L. May*.

*A. ARGUS, Gmelin (*Murex*), 1790.
Ranella vexillum, Sowerby, Conch. Illus., f. 2.
Loc. ? (Census); S. and E. Coasts, *W. L. May*.

*A. EPITREMUS, Ten.-Woods (*Ranella*), P.R.S. Tasm., 1877, p. 133. (Pl. xxiii., fig. 13).
Tasmania (type in Hobart Mus. !); Circular Head, *Mrs. Eddie.* !

Family FUSIDÆ.

Genus FUSUS, Lamarck, 1801.

*F. NOVÆ-HOLLANDIÆ, Reeve, Conch. Icon., f. 70, 1847.
Common (Census); Frederick Henry Bay and East Coast, common, *W. L. May*.

*F. PYRULATUS, Reeve, Conch. Icon., f. 50, 1847.
Circular Head, common (type), *W. F. Petterd* and *W. L. May*.

*F. USTULATUS, Reeve, Conch. Icon., f. 66, 1847.
F. Legrandi, Ten.-Woods, P.R.S.Tasm., 1876, p. 137.
N. Coast, *W. F. Petterd*; E. Coast (type of *F. Legrandi* !).

F. DUNKERI, Jonas, Malak. Beiträg., p. 129, 1844; Philippi, Abbild., ii., p. 191, t. 4, f. 4, 1847.
Siphonalia fuscozonata, Angas, P.Z.S., 1865, t. 2, f. 7-8.
King Island (Census); Flinders Id. and Furneaux Group, *W. F. Petterd.*

Genus LATIROFUSUS, Cossmann, 1889.

*L. SPICERI, Ten.-Woods (*Fusus*), P.R.S.Tasm., 1876, p. 137.
L. nigrofuscus, Tate, T.R.S.S.Aust., xiv. 1891, p. 258, t. 11, f. 3.
King Island (type !).

Genus FASCIOLARIA, Lamarck, 1801.

*F. CORONATA, Lamarck, 1822; Kiener, Mon., t. 9, f. 1; and var. *fusiformis*, Valenciennes, 1843.
King Island (cotype !); (Census).

Family BUCCINIDÆ.

Genus SIPHONALIA, A. Adams, 1863.

*S. DILATATA, Quoy & Gaimard (*Fusus*), Zool. Voy. Astrolabe, *Fusus Tasmaniensis*, Adams & Angas, P.Z.S., 1863, t. 37, f. 1. = *Siphonalia maxima*, Tryon, Man. Conch., iii., t. 54, f. 335, 1881.

S. oligostira, Tate, T.R.S. S. Aust., xiv., 1891, p. 258, t. 11, f. 6.

N. Coast (Census) and *W. L. May*; type of *F. Tasmaniensis*, and common, S. Coast, *W. L. May*; King Island. !

Genus PISANIA, Bivona, 1832.

*P. RETICULATA, A. Adams, P.Z.S. 1854, p. 138; Tryon, Man. Conch., iii., t. 71, f. 201.

Loc. ? (Census); King Island, *R. Tate*; S. and E. Coasts, but not common, *W. L. May*.

Genus CANTHARUS, Mörch, 1852.

*C. CLARKEI, Ten.-Woods (*Siphonalia*), P.R.S. Tasm., 1876, p. 6; *Euthria clarkei*, Hedley, P.L.S.N.S.W., xxv., p. 726, f. 24, 1901

Long Bay (type !); King Island, *R. Tate*; Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May*.

*C. TURRITUS, Ten.-Woods (*Siphonalia*), P.R.S. Tasm., 1876, p. 6. Long Bay (type !); D'Entrecasteaux Channel, *W. L. May*.

*C. EBURNEUS, Petterd (*Trophon*), Journ. Conch., 1884, p. 142. (Text fig. 1).

Tamar Heads (type !).

*C. KINGICOLA, Tate & May, T.R.S.S. Aust., xxiv., p. 91, 1900. (Plate xxiv., fig. 20).

King Island (type; Coll. R. Tate).

Genus COMINELLA, Gray, 1847.

*C. COSTATA, Quoy & Gaimard (*Buccinum*), Voy. Astrolabe, ii., p. 417, t. 30, f. 17-20.

King Island !; Bass Straits, common; S. Coast (rare, Census).

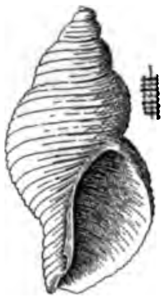


Fig. 1.
C. eburneus.

Var. *Angasi*, Crosse (*Buccinum*), Journ. de Conch., 1864, t. 11, f. 5. "A dark variety of *C. costata*" (Census).

*C. LINEOLATA, Lamarck (*Buccinum*), 1809.
C. alveolata, Kiener (*Buccinum*), Coq. Viv., t. 10, f. 34, 1843.

C. LACTEA, Reeve (*Buccinum*), Conch. Icon., f. 117.
King Island, *R. Tate*; common (Census).
*Var. *Tasmanica*, Ten.-Woods, P.R.S.Tasm., 1876, p. 139.
Long Bay (type); S. Coast, *W. L. May*.

Genus JOSEPHA, Ten.-Woods, 1879.

*J. TASMANICA, Ten.-Woods, P.R.S.Tasm., 1879, p. 32.
Phos Tasmanicus, Verco, T.R.S.S.Aust., xx., 1896, t. 6, f. 5.
N. Tasmania, Loutit Bay, King Island, Kent Group (type and cotypes).

Genus PHOS, Montfort, 1810.

*P. TENUICOSTATUS, Ten.-Woods (*Cominella*), P.R.S.Tasm., 1877, p. 135. (Text fig. 2).
Eagle Hawk Neck (type); Frederick Henry and Adventure Bays, *W. L. May*.

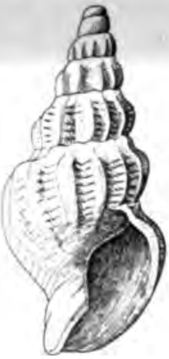


Fig. 2.
P. tenuicostatus.

Family NASSIDÆ.

Genus NASSA, Lamarck, 1799.

*N. FASCIATA, Lamarck (*Buccinum*), 1822; Quoy & Gaimard, Voy. Astrolabe, p. 445, t. 32, f. 18-21.
Tasmania (cotype); common and widely distributed (Census).

*N. JACKSONIANA, Quoy & Gaimard (*Buccinum*), Voy. Astrolabe, t. 32, f. 28-29, 1833.
N. Munieriana, Crosse, Journ. de Conch., 1864, t. 13, f. 6 (a deformed state).
Not uncommon (Census); N.W. Coast for *N. Munieriana*, *R. Tate*.

*N. PAUPERATA, Lamarck (*Buccinum*), 1822; Reeve, Conch. Icon., *Nassa*, t. 5, f. 27.
Common and widely distributed (Census).

*N. **Burchardi**, Dunker (*Buccinum*), in Philippi's Abild., iii., t 2, f. 14, 1849.

N. labecula, A. Adams, P.Z.S., 1851, p. 98; Reeve, Conch. Icon., f. 166.

Swan Point, Tamar River, *R. Tate*.

*N. **lirella**, Reeve, Conch. Icon., t. 5, f. 27, 1853.

N. Tasmanica, Ten.-Woods, P.R.S.Tasm., 1876, p. 150.

Type of *N. Tasmanica*; rather common, N. and E. Coasts, *Ten.-Woods*.

*N. **paupera**, Gould, 1850; Wilkes Exped., 262, f. 330.

N. tringa, Sowerby, Journ. de Conch., 1864, t. 10, f. 7.

N. compacta, Angas, P.Z.S., 1865, p. 154.

N. rufocincta, Angas, P.Z.S., 1867; Ten.-Woods, Census, 1878, p. 29; non Adams, 1851.

Bass Straits; Pig Island, Tamar (Census); King Island, *R. Tate*; Frederick Henry Bay, *W. L. May*.

Family VOLUTIDÆ.

Genus VOLUTA, Linné, 1758.

Section *Amoria*

*V. **undulata**, Lamarck, 1822; Quoy & Gaimard, Voy. Astrolabe, t. 44, f. 1-2, 1833.

V. Angasi, Sowerby, Thes. Conch., f. 99.

Bass Straits and Maria Island (Lamarck); common (Census).

V. Kingii, Cox, P.Z.S., 1869, t. 26, f. 3. "A pale variety peculiar to the islands of Bass Straits" (Census).

V. Sclateri, Cox, P.Z.S., 1869, f. 26.

Flinders Island (Census).

Section *Alcithoe.*

*V. **fusiformis**, Swainson, Appx. Bligh Cat.; Reeve, Conch. Icon., f. 6, 1849.

Common, N. W. (Census); Frederick Henry Bay, *W. L. May*.

*Var. *micropapillosa*, Beddome, P.R.S. Tasm., 1897, p. 86.

River Derwent.

*V. PAPILLOSA, Swainson, Appx. Bligh Cat.
V. papillaris, Reeve, Conch. Icon., f. 10, 1849.
Loc. ? (Census); Circular Head, *W. L. May.*
Var. *Macquariensis*, Petterd, Journ. Conch., 1879, p. 343, is of a yellow colour without markings.
Macquarie Harbour.

*V. ROADKNIGHTÆ, McCoy, Ann. Mag. Nat. Hist., 1881, p. 89, t. 7, f. 2.
Maria Island, *W. L. May;* E. Coast near Swansea, *Mrs. Irvine.*

Section *Mamillina.*

*V. MAMILLA, Gray (*Cymba*), P.Z.S., 1844, p. 149; *Voluta mamilla*, Reeve, Conch. Icon., f. 44, 1849.
N. Coast, extremely rare (Census); Frederick Henry Bay and E. Coast, *W. L. May.*

Genus LYRIA, Gray, 1847.

L. MITRAEFORMIS, Lamarck (*Voluta*), 1822; Reeve, Conch. Icon., f. 7, 1849.
Rarely seen in Bass Straits (Census).

Family MITRIDÆ.

Genus MITRA, Lamarck, 1799.

*M. GLABRA, Swainson, Exotic Conch., i., t. 24, 1821.
M. buccinata, Quoy & Gaimard, Voy. Astrolabe, t. 45 bis, f. 14-15, 1833.
**M. declivis*, Reeve, Conch. Icon., f. 44, 1849.
Rare (Census); Frederick Henry Bay, *W. L. May.*

*M. AUSTRALIS, Swainson, Zool. Illust., i., p. 18.
M. melaleuca, Quoy & Gaimard, Voy. Astrolabe, t. 45, f. 26-27. 1833.
N. and E. Coasts, rather rare (Census); King Island. !

*M. BADIA, Reeve, Conch. Icon., f. 157, 1844.
M. Rosettæ, Angas, P.Z.S., 1865, t. 2, f. 6.
A common shell (Census).

*M. PICA, Reeve, Conch. Icon., f. 247, 1845.
Rather common (Census); E. and S. Coasts, *W. L. May;* King Island. !

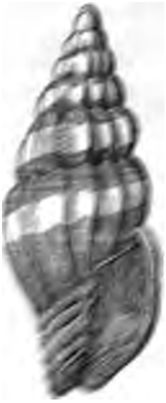
*M. CINNAMOMEA, A. Adams (*Volutomitra*), P.Z.S., 1854, p. 134.
Natal (Mus. Cuming); Oyster Bay, Tasmania, *Dr. Milligan* (many specimens in Brit. Mus.).

Genus TURRIS, Montfort, 1810.

Turricula, Klein, 1753 (preLinnean .

*T. FRANCISCANA, Ten.-Woods (*Mitra*), P.R.S. Tasm., 1877, p. 133. (Pl. xxiv., fig. 20).
Tamar Heads (type); Derwent Estuary, *W. L. May.*

*T. SCALARIFORMIS, Ten.-Woods (*Mitra*), P.R.S. Tasm., p. 140, 1876. (Text fig. 3).
Long Bay (type); D'Entrecasteaux Channel, *W. L. May.*



*T. TASMANICUS, Ten.-Woods (*Mitra*), P.R.S. Tasm., 1876, p. 139.
Rare, *Ten.-Woods;* D'Entrecasteaux Channel, *W. L. May.*

*T. LEGRANDI, Ten.-Woods (*Mitra*), P.R.S. Tasm., 1875, p. 140; and id., 1877, p. 34.
King Island (type); N. and E. Coasts, *W. L. May.*

*T. SCHOMBURGKI, Angas (*Mitra*), P.Z.S., 1878, p. 313, t. 18, f. 12-13.
**M. Legrandi* (pars), Ten.-Woods, P.R.S. Tasm. [illegible] 1878, p. 34. *Turricula Legrandi*, Hedley [illegible] Rec. Aust. Mus., iii., 1900, p. 218 [illegible] Atkinson = *juvenile*.
Circular Head, *Ten.-Woods;* King Island, *R. Tate;* [illegible] *W. L. May.*

*T. FUSCA, A. Adams (*Volutomitra*), P.Z.S., 1855, p. [illegible] *M. vincta*, Sowerby, Thes. Conch., [illegible] 23, f. 920, 921, 925.

M. Teresiæ, Ten.-Woods, P.R.S. Tasm., 1876, p. 140; *M. scita*, Ten.-Woods, 1876, p. 141.
M. Weldii, Ten.-Woods, 1878, p. 31.
King Island !; Circular Head, Long Bay, Blackman's Bay, *Ten.-Woods;* S. and E. Coasts, *W. L. May;* Oyster Bay, *Dr. Milligan* (in Brit. Mus., Sowerby's types).
We have no evidence of the claims of *M. Capensis*, DK., 1845, or of *M. rufocincta*, A. Adams, 1851, to be used in substitution.

Family MARGINELLIDÆ.

Genus MARGINELLA, Lamarck, 1801.

*M. MAYII, Tate, T.R.S.S. Aust., xxiv. p. 93, 1900. **(Pl. xxvii., fig. 84).**
E. Coast, *W. L. May.*

*M. ALLPORTI, Ten.-Woods, P.R.S. Tasm., 1876, p. 28. **(Pl. xxvi., fig. 80).**
Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May;* Long Bay (type).

*M. FORMICULA, Lamarck, 1822; Reeve, Conch. Icon., f. 28.
Maria Island (type); common (Census).

*M. MUSCARIA, Lamarck, 1822; Reeve, Conch. Icon., f. 29, 1864.
Maria Island (type); very common (Census) on the E. Coast, *W. L May.*

*Var. *minor*, *M. Johnstoni*, Petterd, Journ Conch., p. 43, 1884.
N. and E. Coasts, *W. F. Petterd.*

*M. TURBINATA, Sowerby, Thes. Conch., 1846, t. 75, f. 70.
E. and S Coasts, *W. L. May*; S. Coast, rare (Census).

*M. VOLUTIFORMIS, Reeve, Conch. Icon., f. 131, 1865.
King Island, *R. Tate;* somewhat common [and widely spread] (Census).

*M. TASMANICA, Ten.-Woods, P.R.S. Tasm., 1876, p. 28; Tryon, Man. v., p. 23, t. 7, f. 6 (original).

*M. STANISLAS, Ten.-Woods, P.R.S. Tasm., 1877, p. 133. **(Pl. xxvi., fig. 82).**

Erato pellucida, Ten.-Woods, *op. cit.*, 1879, p. 35.
Var. *albida*, Tate, T.R.S.S.Aust., 1878, p. 87.
Blackman's Bay and Table Capes (types); Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May;* King Island. !

*M. STRANGEI, Angas, P.Z.S., 1877, p. 172, t. 26, f. 8.
**M. subbulbosa*, Tate, T.R.S.S.Aust., i., p. 86, 1878.
**M. denticulata* (pars), Tate, *op. cit.*, p. 87.
**M. Beddomei*, Petterd, Journ. Conch., 1884, p. 143.
Frederick Henry Bay, *W. L. May;* Southern Coasts, *W. F. Petterd* ! (for *M. Beddomei*).

*M. TRIDENTATA, Tate, T.R.S.S.Aust., i., p. 87, 1878. (Pl. xxvi., fig. 81).
M. mixta, Petterd, Journ. Conch., 1884, p. 143.
Circular Head, *W. F. Petterd* !; Brown River, *W. L. May*.

M. LUBRICA, Petterd (*Volvaria*), Journ. Conch., 1884, p. 143.
Brown River (type).

*M. BIPLICATA, Tate & May, (see post) T.R.S.S.Aust., xxiv., p. 92, 1900. (Pl. xxvii., fig. 87).
Port Esperance in 24 fathoms, *W. L. May*.

*M. OVULUM, Sowerby, Thes. Conch., i., 1846, t. 78, f. 188.
M. Petterdi, Beddome, P.R.S.Tasm., 1883, p. 167.
Derwent Estuary, *W. L. May;* Kelso Bay, Tamar River (type of *M. Petterdi* !).

*M. TENISONI, Pritchard, Vict. Nat., xvii., p. 55, 1900.
M. cypraeoides, Ten.-Woods, P.R.S.Tasm., 1878, p. 122.
Frederick Henry Bay, *W. L. May;* Blackman's Bay (type !, in Hobart Mus.); King Island !.

*M. PUMILIO, Tate & May (*nom. mut.*). (Pl. xxvi., fig. 79).
M. minutissima, Ten.-Woods, P.R.S.Tasm., 1876, p. 27, non Michelin.
Long Bay (Coll. W. F. Petterd); (type ! in Hobart Mus.).

*M. CRATERICULA, Tate & May, T.R.S.S.Aust., xxiv., p. 91, 1900 (see post). (Pl. xxvi., fig. 74).
Off Tinderbox Bay in D'Entrecasteaux Channel.

*M. OVULAEFORMIS, Tate & May, T.R.S.S.Aust., xxiv., p. 91, 1900 (see post). (Pl. xxvii., fig. 92).
Erato lactea, Petterd, MS., non Hutton.
Loc. ? (type !, Coll. W. F. Petterd).

*M. CYMBALUM, Tate, T.R.S.S.Aust., i., 1878, p 87. (Pl. xxvi., fig. 83).
Long Bay, *W. F. Petterd* ! (Coll. Miss Lodder !).

*M. SIMSONI, Tate & May, T.R.S.S.Aust., xxiv., p. 92, 1900. (Pl. xxvii., fig. 98; Pl. xxvi., fig. 78).
M. denticulata (pars), Tate, T.R S.S.Aust., i., p.87, 1878 ; non Conrad, 1830.
M. minima, Petterd, Journ. Conch., 1884, p.144; non Sowerby, 1846.
Frederick Henry Bay, *W. L. May;* Long Bay (type ! of *M. minima*).

*M. MULTIPLICATA, Tate & May, T.R.S.S.Aust., xxiv., p.91, 1900 (see post). (Pl. xxvii., fig. 88).
(Type in Hobart Mus.).

Family OLIVIDÆ.

Genus OLIVELLA, Swainson, 1835.

O. AUSTRALIS, Ten -Woods, P.R.S.Victoria, 1878, p.55.
Clark's Island (type in Nat. Mus., Melbourne).

*O. LEUCOZONA, Adams & Angas, P.Z.S., 1863, p.422; t. 37, f. 23.
Oliva hieroglyphica, Ten.-Woods, non Reeve.
Frederick Henry Bay, *W. L. May:* Brown's River (Census).

*O. NYMPHA, Adams & Angas, P.Z.S., 1863, p. 422; Weinkauff in Kuster's Conch. Cab., 1878, t. 38, f. 10, copied by Tryon, v., t. 17, f. 46.
Tamar Heads, *W. F. Petterd* !.

Genus ANCILLA, Lamarck, 1799.

*A. MARGINATA, Lamarck, 1810; Reeve, Conch. Icon., f.8, 1864.
King Island and Circular Head (Census): Frederick Henry Bay, *W. L. May*.

*A. **OBLONGA**, Sowerby, 1830; Reeve, Conch. Icon., t. 8, f. 24.
A. fusiformis, Petterd, P.R.S.Tasm., 1886, p. 342.
Swan Island, Bass Straits (type of *A. fusiformis* !).

*A. **PETTERDI**, Tate, T.R S.S. Aust., 1893, p. 199. (Pl. xxv., fig. 42).
A. obtusa, Petterd, P.R.S.Tasm., 1886, p. 342.
King Island, *R. Tate;* N.W. Coast (type).

Family COLUMBELLIDÆ.

Genus COLUMBELLA, Lamarck, 1799.

Subgenus MITRELLA, Risso, 1826.

*C. **SEMICONVEXA**, Lamarck (*Buccinum*), 1822; Reeve, Conch. Icon., *Columbella*, f. 95, 1858.
C. rosacea, Reeve, Conch. Icon., f. 183, 1859.
Tasmania (type of *C rosacea*); common (Census); King Island, *R. Tate.*

*C. **LINCOLNENSIS**, Reeve, Conch. Icon., f. 184, 1859.
Common (Census).

*C. **MENKEANA**, Reeve, Conch. Icon., f. 69, 1858.
C. xavieriana, Ten.-Woods, P.R.S. Tasm., 1877, p. 134; Tryon, Man. Conch., v., p. 137, t. 51, f. 50 (original).
N. Coast (type of *C. xavieriana*), King Island !.

C. **IRRORATA**, Reeve, Conch. Icon., f. 150, 1859.
King Island; very common (Census).

*C. **AUSTRINA**, Gaskoin, P.Z.S., 1851, p. 9; Reeve, Conch. Icon., f. 100.
N. Coast, *W. L. May.*

*C. **ATTENUATA**, Angas, P.Z.S., 1871, t. 1, f. 4.
Terebra Beddomei, Petterd, Journ. Conch., 1884, p. 142.
Brown's River (Petterd's type !); Pirate's Bay, *W. L. May.*

*C. **ANGASI**, Brazier, P.Z.S., 1871, p. 322.
C. interrupta, Angas, P.Z.S., 1865, p. 56, t. 2, f. 9-10, non Gaskoin.
C. minuta, Ten.-Woods, P.R.S.Tasm., 1876, p. 152.

C. minima, Ten.-Woods, *op. cit.*, 1878 (*nom. mut.*).
C. Tenisoni, Tryon, Man. Conch., v., p. 128, t. 49, f. 10, 1883.
Swansea (type of *C. minuta*); Frederick Henry Bay, *W. L. May*.

*C. ATKINSONI, Ten.-Woods, sp.
Mangelia Atkinsoni, Ten.-Woods, P.R.S.Tasm., 1876, p. 142.
Columbella speciosa, Angas, P.Z.S., 1877, t. 5, f. 3.
E. Coast (type !); S. Coast, *W. L. May*.

*C. LINEOLATA, Brazier, P.L.S.N.S.W., 1877, p. 231; Tryon, Man. Conch., v., p. 138, t. 51, f. 53 (indifferent).
Cloudy Bay, *W. L. May*.

*C. SACCAHARATA, Reeve, Conch.Icon., t. 29, f. 187, 1859. (Pl. xxiv., fig. 19).
**C. miltostoma*, Ten.-Woods, P.R.S. Tasm., 1877, p. 134.
C. unisulcata, Kobelt, Conch. Cab., 1892, t. 17, f. 15-16 (apud Pritchard & Gatliff).
Oyster Bay, *Dr. Milligan* (Brit. Mus. types); N. Coast; Frederick Henry Bay, very common, *W. L. May*.

*C. TENUIS, Gaskoin, P.Z.S., 1861, p. 2; Reeve, Conch. Icon., f. 224, 1858.
C. pulla, Gaskoin, 1851, p. 6; Reeve, f. 106.
C. badia, Ten.-Woods, P.R.S. Tasm., 1876, p. 151; Tryon, Man. Conch., v., t. 49, f. 6 (original),
C. Roblini, Ten.-Woods, *loc. cit.*, p. 151; Tryon, *loc. cit.*, t. 49, f. 7 (original).
E. Coast, common, *Ten.-Woods*: King Island, *R. Tate*; general, *W. L. May*; King Island !.

C. NUPECULATA, Reeve, Conch. Icon., f. 234, 1859.
**C. dictua*, Ten.-Woods, P.R.S.Tasm., 1879, p. 34; Tryon, Man. Conch., v., p. 126, t. 48, f. 96 (original).
N. Coast (type); King Island, *R. Tate*.

*C. VINCTA, Tate, T R.S.S.Aust., xvii., p. 190, t. 1, f. 11, 1893.
N. Coast, *R. Tate*: Frederick Henry Bay, *W. L. May*.

*C. ALBOMACULATA, Angas, P.Z.S., 1867, t. 13, f. 5.

*C. **Legrandi**, Ten.-Woods, P.R.S.Tasm., 1876, p. 152; Tryon, Man. Conch., v., p. 137, t. 51, f. 49 (original).
King Island (type); Frederick Henry Bay, *W. L. May*.

C. **filosa**, Angas, P.Z.S., 1867, p. 195, t. 13, f. 6.
N. Coast, rare (Census).

Family TEREBRIDÆ.

Genus Terebra, Lamarck, (apud Adanson, 1757).

*T. **Kieneri**, Deshayes, P.Z.S., 1859, p. 294; Reeve, Conch. Icon., f. 110, 1850: *T. spectabilis*, Tryon, Man. Conch., vii., t. 4, f. 56, 1885 (non Hinds).
Type of *Kieneri*, Port Arthur (Census); (Hobart Mus. !).

T. **brevicula**, Deshayes, P.Z.S., 1852; Reeve, Conch. Icon., f. 119, 1860.
Type, reputed to Tasmania; not known to collectors.

*T. **ustulata**, Deshayes, Journ. de Conch., 1857, t. 3, f. 12.
S. Coast (type), rare, *W. L. May*.

*T. **bicolor**, Angas, P.Z.S., 1867, p. 111, t. 13, f. 7.
Loc. ? (Census); Frederick Henry Bay, rare, *W. L. May*

*T. **Brazieri**, Angas, P.Z.S., 1871, p. 16, t. 1, f. 15.
T. acuticosta, Ten.-Woods !.
E. Coast (Census); general but rare, *W. L. May*.

T. **albida**, Gray, P.Z.S., 1834; Reeve, Conch. Icon., f. 79.
King Island, *R. Tate*.

Family CONIDÆ.

Genus Conus, 1758.

*C. **anemone**, Lamarck, 1810.
C. Novæ-Hollandiæ, A Adams, P.Z.S., 1853, p. 119.
Common (Census); King Island, *R. Tate*.
Var. *C. Carmeli*, Ten.-Woods, P.R.S.Tasm., 1877, p. 134.
N. Coast (type).

*C. **rutilus**, Menke, Moll. Nov.-Holl., 1843, p.27; Reeve, Conch. Icon., f. 264, 1844.

C. Tasmanicus, Ten.-Woods, P.R.S.Tasm., 1876, p. 139.
C. Macleayana, Ten.-Woods, *loc. cit.*, 1877, p. 134.
Very rare, *Ten.-Woods;* King Island !.

Family PLEUROTOMIDÆ.

Genus HEMIPLEUROTOMA, Cossmann, 1889.

*H. QUOYI, Desmoulins (*Pleurotoma*), 1842.
P. monile, Kiener, Coq. Viv., p. 52, t. 15, f. 3 (*nom. praeocc*).
P. Philipineri, Ten.-Woods, P.R.S.Tasm., 1877, p. 136.
Tasmania (Brit. Mus.); N.W. Coast (Woods' type); D'Entrecasteaux Channel, *W. L. May*.

Genus DRILLIA, Gray, 1838.

*D. BERAUDIANA, Crosse (*Pleurotoma*), Journ. de Conch., 1863, p. 88, t. 1, f. 6.
Drillia Beraudiana, Ten.-Woods, P.R.S. Tasm., 1878.
D. tæniata, Ten.-Woods, *op. cit.*, 1879, p. 36.
S. Coast, rare; King Island !, common (Census); E. Coast, *W. L. May;* Flinders Island (type of *D. tæniata*).

D. COXI, Angas, P.Z.S., 1867, t. 13, f. 15, p. 113.
Long Bay (Census); N. Coast, *W. F. Petterd.*

*D. CANCELLATA, Beddome (*Mangelia*), P.R.S.Tasm., 1883, p. 167 **(Pl. xxiv., fig. 27)**.
Kelso Bay in Tamar River (type); Circular Head, *W. F. Petterd* !; Frederick Henry Bay, rare, *W. L. May*.

*D. WOODSI, Beddome, P.R.S.Tasm., 1883, p. 167.
D. Howitti, Pritchard & Gatliff, P.R.S.Vict., xii., t. 8, f. 2, p. 101, 1899.
Var. *D. Bednalli*, G. B. Sowerby, Mal. Soc., ii., 1896, t. 3, f. 3, p. 25.
Long Bay in D'Entrecasteaux Channel (type); Frederick Henry Bay, *W. L. May;* King Island, *R. Tate*.

*D. AGNEWI, Ten.-Woods, P.R.S.Tasm., 1879, p. 36. **(Pl. xxiv., fig. 29)**.
Table Cape (type ! in Hobart Mus.).

*D. IMMACULATA, Ten.-Woods (*Mangelia*), P.R.S. Tasm., 1876, p. 142.

Drillia gabrieli, Pritchard & Gatliff, P.R.S.Vict., 1899, t. 8, f. 1, p. 100.

King Island (type ! in Hobart Mus.); also Victoria (Coll. J. H. Gatliff !).

Genus MANGELIA, Risso, 1826.

*M. ANOMALA, Angas (*Purpura* , P.Z.S., 1877, p. 34, pl. v.,

Mangelia anomala, Tate, P.L.S.N.S.W., v., 1881, p. 131.

N. Coast, *W. L. May* (Hobart Mus.).

*M. VINCENTIANA, Crosse (*Pleurotoma*), Journ. de Conch., 1865, p. 422, t. 11, f. 6.

King Island, *R. Tate; W. L. May.*

*M. ALUCINANS, G. B. Sowerby, Mal. Soc., ii., 1896, p. 29, t. 3, f. 12.

Long Bay, *W. L. May and Rev. H. D. Atkinson* !.

*M. PAUCIMACULATA, Angas (*Glyphostoma*), P.Z.S., 1880, p. 416, t. 11, f. 7.

Pirate's Bay, *W. L. May.*

*M. ST. GALLÆ, Ten.-Woods, P.R.S.Tasm., 1877, p. 137; and var. *Benedicti.* (Pl. xxiv., fig. 33).

N.W. Coast (types).

*M. DELICATULA, Ten.-Woods, P.R.S.Tasm., 1879, p. 37. (Pl. xxiv., fig. 35).

Daphnella delicatula, Tryon, Man. Conch., vii., p. 332, t. 32, f. 29 (bad, ex Hobart Mus.).

M. cuspis, G. B. Sowerby, Mal. Soc., ii., 1896, p. 31, t. 3, f. 17.

Long Bay (type); D'Entrecasteaux Channel, *W. L. May.*

*M. TASMANICA, Ten.-Woods (*Cithara*), P.R.S. Tasm., 1876, p. 145.

M. Jacksoniensis, Angas, P.Z.S., 1877, p. 37, t. 22, f. 73.

M. alternata, Ten.-Woods, P.R.S.Tasm., 1879, p. 39. (Text fig. 5).

E. Coast, rare (types of T. Woods); Frederick Henry Bay, *W. L. May.*

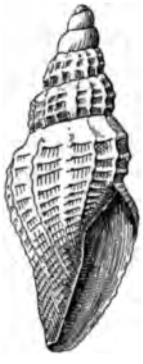


Fig. 4.
M. alternata.

*M. McCoyi, Petterd (*Cythara*), Journ. Conch., ii., 1879, p. 103.
Brown River (type).

*M. PICTA, Adams & Angas, P.Z.S., 1863, p. 419, t. 37, f. 7.
M. Meredithæ, Ten.-Woods, P.R.S.Tasm., 1876, p. 142.
Bass Straits, moderately common, *Ten.-Woods;* King Island, *R. Tate;* N. and E. Coasts, *W. L. May.*

*M. FLACCIDA, Pritchard & Gatliff, P.R.S.Vict., xii., t. 8, f. 3-4, p. 102, 1899.
W. L. May.

*M. AUSTRALIS, Adams & Angas (*Bela*), P.Z.S., 1863, p. 420.
Var. *Bela mitralis*, Adams & Angas, *op. cit.*
Common (Census); King Island, *R. Tate.*

*M. Adcocki, G. B. Sowerby, Mal. Soc., ii., 1896, p 29, t. iii., f. 18.
M. bella, Ad. & Ang. (not Hinds), P.Z.S., 1863, p. 419, pl. xxxvii., f. 6.
N. Coast.

Genus CYTHARA, Schumacher, 1817.

*C. COMPTA, Adams & Angas, P.Z.S., 1863, p. 419, t. 37, f. 5.
Daphnella varix, Ten.-Woods, P.R.S.Tasm., 1877, p. 10.
Tamar Heads (type of *D. varix*); King Island !.

*C. Kingensis, Petterd (*Daphnella*), Journ. Conch., ii., 1879, p. 102.
C. cognata, Pritchard & Gatliff, P.R.S.Vict., xii., 1899, p. 103, t. 8, f. 5.
King Island (type !); Frederick Henry Bay, *W. L. May.*

Genus CLATHURELLA, Carpenter, 1857.

*C. MODESTA, Angas, P.Z.S., 1877, p 38, t. 5, f. 15.
Frederick Henry Bay, *W. L. May.*

*C. GRANULOSISSIMA, Ten.-Woods, P.R.S.Tasm., 1879, p 37. (Pl. xxiv., fig. 34).
North Tasmania, *Ten.-Woods;* D'Entrecasteaux Channel, *W. L. May.*

*C. **Lallemantiana**, Crosse & Fischer, Journ. de Conch., 1865, p. 423, t. 2, f. 5.

**Drillia incrusta*, Ten.-Woods, P.R.S.Tasm., 1877, p. 136; Tryon, Man. Conch., vi., t. 34, f. 99 (ex cab. C. E. Beddome).

Blackman's Bay and N. Coast (for *D. incrusta*); D'Entrecasteaux Channel, *W. L. May*.

*C. **Letourneuxiana**, Crosse & Fischer, Journ. de Conch., 1865, p. 425, t. 11, f. 7.

Not common (Census); Frederick Henry Bay, *W. L. May*.

*C. **philomenæ**, Ten.-Woods, P.R.S.Tasm., 1876, p. 141.

Drillia Atkinsoni, Ten.-Woods, *loc. cit.*, 1876, p. 143.

Siphonalia pulchra, Ten.-Woods, *loc. cit.*, 1877, p. 139.

C. crassina, Angas, P.Z.S., 1880, p. 416, t. 40, f. 6.

Rather common, E. Coast (type); King Island, *R. Tate*.

*C. **sculptilis**, Angas, P.Z.S., 1871, p. 17, t. 1, f. 19.

Long Bay, *Ten.-Woods* !, *op. cit.*, 1879, p. 38.

*C. **sculptilior**, Ten.-Woods, P.R.S.Tasm., 1879, p. 38 (non Tryon, Man. Conch., vi., t. 32, f. 27, ex Hobart Mus.).

Drillia Legrandi, Beddome, P.R.S.Tasm., 1883, p. 167; Hedley, P.L.S.N.S.W., 1900, p. 509, pl. xxvi., ff. 1, 2, 3.

Long Bay (type), *W. F. Petterd* !; D'Entrecasteaux Channel, *W. L. May*.

*C. **Desalesi**, Ten.-Woods (*Mangelia*), P.R.S.Tasm., 1877, p. 138; Hedley, Rec. Aust. Museum, iv., 1901, p. 23, f. 4. (Pl. xxiv., fig. 32).

Long Bay (type); islands in Bass Straits, *W. F. Petterd;* Frederick Henry Bay, *W. L. May*.

*C. **kymatoessa**, Watson (*Drillia*), Challenger Exped., xv., t. 26, f. 5.

Drillia minuta, Tryon, Man. Conch., vi., t. 34, f. 93 (ex cab. C. E. Beddome), non. Ten.-Woods.

Long Bay (Colls. Rev. H. D. Atkinson and W. L. May).

Genus DAPHNELLA, Hinds, 1844.

*D. MINUTA, Ten.-Woods, P.R.S.Tasm., 1877, p. 136. (Pl. xxiv., fig. 28).
Long Bay (type); Frederick Henry Bay, *W. L. May*.

*D. TASMANICA, Ten.-Woods, P.R.S. Tasm., 1877, p. 138; Hedley, P.L.S.N.S.W., xxv., p. 725, f. 21, 1901.
Long Bay and Blackman's Bay (types); D'Entrecasteaux Channel, *W. L. May*.

*D. HARRISONI, Ten.-Woods (*Mangelia*), P.R.S.Vict., 1877, p. 56.
Euryta pulchella, Adams & Angas, P.Z.S., 1863, t. 37, f. 14 (non *Terebra pulchella*, Deshayes).
Euryta Brazieri, Angas, P.Z.S., 1875, t. 45, f. 5 (non *Terebra Brazieri*, Angas, 1871).
Daphnella Harrissoni, Tryon, Man. Conch., vi., p. 306.
Terebra (Euryta) Angasi, Tryon, Man. Conch., vii., p. 38.
Clark Island (type).

Genus MITROMORPHA, A. Adams, 1865.

*M. ALBA, Petterd (*Columbella*), Journ. Conch., ii., 1879, p. 104.
M. alba, Tate, P.R.S.N.S.W., 1898, p. 397.
M. Flindersi, Pritchard & Gatliff, P.R.S.Vict., xii., p. 104, t. 8, f. 6 (incorrect).
Blackman's Bay (type); E. and S. Coasts, *W. L. May*; King Island !.

Genus DONOVANIA, Bucq. Dollf. Dautz., 1882.

Lachesis, Risso, 1826, non Daudin, 1804.

*D. FENESTRATA, Tate & May, T.R.S.S.Aust., xxiv., p. 94, 1900. (Pl. xxiv., fig. 36).
E. Coast (type), *W. L. May*.

Family CANCELLARIIDÆ.

Genus CANCELLARIA, Lamarck, 1799.

*C. GRANOSA, Sowerby, Conch. Illus., t. 10, f. 17 (non 16), 1841.
Loc. ? (Census); Circular Head, *W. L. May*.

*C. LÆVIGATA. Sowerby, Conch. Illus., f. 24, 1841; Reeve, Icon., f. 34a.

C. undulata, Sowerby, P.Z.S., 1848, p. 136; Thes. Conch., ii., t. 92, f. 12, t. 95, f. 79.

Tasmania (type of *C. undulata*); King Island, *R. Tate;* Circular Head, *W. L. May.* *C. lævigata*, Sowerby, and *C. purpuriformis*, Reeve, in the Brit. Mus. are identical (R. Tate), and worn examples of *C. undulata* (Dr. Verco).

*C. SPIRATA, Lamarck, 1822; Reeve, Conch. Icon., f. 56.

C. excavata, Sowerby, P.Z.S., 1848, p. 137.

N.W. Coast, rare (Census).

C. PURPURIFORMIS [Valenciennes], Küster, Coq. Viv., t. 7, f. 4; Reeve, Conch. Icon., f. 766.

C. Tasmanica, Ten.-Woods, P.R.S.Tasm., 1876, p. 150.

C. MacCoyi, Pritchard & Gatliff, P.R.S.Vict., xi., 1899, p. 182, t. 20, f. 6.

King Island (type).

Note.—Küster's figured example is of medium growth

Family CASSIDÆ.

Genus SEMICASSIS, Mörch, 1852.

*S. SEMIGRANOSA, Lamarck (*Cassis*), 1822; Reeve, Conch. Icon., f. 3, 1848.

Common, S. and E. Coasts, *W. L. May;* King Island !.

*S. PYRUM, Lamarck (*Cassis*), 1822; Reeve, Conch. Icon., f. 3, 1848.

Cassis paucirugis, Menke.

Cassis nivea, Brazier, P.Z.S., 1872, p. 616, t. 44, f. 1.

Cassis tumida. Petterd, P.R.S.Tasm., 1886.

General, *W. L. May:* Macquarie Harbour (type of *S. nivea*); also Storm Bay and E. Coast, *W. L. May;* River Leven (type of *S. tumida*).

Family STRUTHIOLARIIDÆ.

Genus ZEMIRA, H. A. Adams, 1853.

*Z. AUSTRALIS, Sowerby (*Eburna*), Conch. Illus., t. 20, f. 5, 1841; Reeve, Conch. Icon., f. 4, 1859.

E. Coast, rather rare (Census); Flinders Island, *W. L. May.*

Family CYPRÆIDÆ.

Genus CYPRÆA, Linné, 1767.

Subgenus LUPONIA, Gray, 1832.

*C. ANGUSTATA, Gmelin, 1788; Reeve, Conch. Icon., f. 91, 1846; Beddome, P.L.S.N.S.W., xxii., p. 568, t. 21, f. 1-3, 1898.

Var. *C. Comptoni*, Gray, 1847; Beddome, *op. cit.*, t. 21, f. 15-16.

Var. *C. declivis*, Sowerby, Thes. Conch., 1870, f. 287, 328, 329 (type from Tasmania), Beddome, *op. cit.*, p. 571, t. 21, f. 12-14.

C. angustata, var. *Mayi*, Beddome, *op. cit.*, t. 21, f. 4-7.

Var. *subcarnea*, *op. cit.*, t. 21, f. 8-9.

Var. *albata*, *op. cit.*, t. 21, f. 11.

Common (Census).

*C. PIPERATA, Gray, Zool. Journ., 1824, p. 498; Sowerby, Thes. Conch., 1870, f. 285, 286; Beddome, *op. cit.*, p. 574, t. 21, f. 17-18.

Var. *C. bicolor*, Gaskoin, 1848; Sowerby, Thes. Conch., f. 288-289.

Not common (Census); Rocky Cape; Flinders Island, *Beddome;* E. and S. Coasts, *W. L. May;* King Island !.

Subgenus CYPRÆOVULA, Gray, 1824.

*C. UMBILICATA, Sowerby, Tankerville Cat. Appex., p. 30, t. 7, 1825; Thes. Conch., iv., t. 298, f. 42-44; Beddome, P.L.S. N.S.W. xxii., t. 20.

Rare, N. Coast and Barren Island (Census); Marion Bay on E. Coast, *W. L. May.*

Genus TRIVIA, Gray, 1832.

*T. AUSTRALIS, Lamarck (*Cypræa*), 1822; Reeve, Conch. Icon., f. 138, 1846.

Genus ERATO, Risso, 1826.

*E. LACHRYMA, Gray, Descript. Cat., 1832, p. 17; Reeve, Conch. Icon., f. 9, 1865.
E. denticulata, Prit. & Gat., P.R.S.Vict., xiii., 1900, p. 133, pl. xx., f. 5.
(Coll. Miss Lodder !).

*E. BIMACULATA, Tate, T.R.S.S.Aust., i., 1878, p. 88. **(Pl. xxiii., fig. 6).**
N.W. Coast, *W. Legrand* (Coll. R. Tate).

Family NATICIDÆ.

Genus POLINICES, Montfort, 1810.

P. TASMANICA, Ten.-Woods, P.R.S.Tasm., 1876, p. 148. **(Pl. xxv., fig. 49).**
E., S.E., and S. Coasts, *Ten.-Woods;* Pirate's Bay, *W. L. May.*

*P. AMPLA, Philippi, 1848; Conch. Cab., iii., t. 1, f. 1-4, 1852.
Natica Lamarckiana, Reeve, Conch. Icon., f. 6, 1852.
Bass Straits (Census); (Colls. W. L. May and Rev. T. Hull !).

*P. CONICA, Lamarck, 1819; Delessert, Recueil, t. 32, f. 3, 1841; Reeve, Conch. Icon., f. 48, 1855.
Common (Census).

Genus NATICA, Lamarck, apud Adanson, 1757.

*N. BEDDOMEI, Johnston, P.R.S.Tasm., 1885, pp. 208 and 222.
N. polita (pars), Ten.-Woods, P.R.S.Tasm., 1876, p. 23.
N. effosa, Watson, Challenger Zool., t. 28, f. 3, 1886.
Bruni Island (Census); Frederick Henry Bay, *W. L. May.*

N. SUBCOSTATA, Ten.-Woods, P.L.S.N.S.W., ii., 1878, p. 263; Pritchard & Gatliff, P.R S.Vict., 1900, p. 132, t. 20, f. 1-3.
E. Coast, *W. L. May.*

*N. AREOLATA, Récluz, P.Z.S., 1843, p. 206; Küster, Conch. Cab., t. 11, f. 2.
Circular Head and S.E. Coast, *W. L. May.*

*N. **Tenisoni**, Tate & May, T.R.S.S.Aust., xxiv., p. 94, 1900.
N. nana, Ten.-Woods, P.R.S.Tasm., 1876, p. 149, non Möller.
Long Bay (type).

Subgenus Stigmaulax, Mörch, 1852.

*N. **umbilicata**, Quoy & Gaimard, Voy. Astrolabe, t. 66, f. 22-23.
N. globosa, Ten.-Woods (*Ruma*), P.R.S.Tasm., 1876, p. 149, is a white variety.
Common (Census); King Island, *R. Tate.*

Genus Sigaretus, Lamarck, 1799.

*S. **zonalis**, Quoy & Gaimard (*Cryptosoma*), Voy. Astrolabe, t. 66*, f. 1-3, 1832.
Common (Census).

Family VANIKORIDÆ.

Genus Vanikoro, Q. & G., 1832.

Narica, D'Orbigny, 1842.

V. **Orbignyana**, Récluz (*Narica*), P.Z.S., 1843, p. 140, and Guérin's Mag., t. 124, f. 2, 1845.
Type.

Family MARSENIIDÆ.

Genus Marsenia, Gray, 1850.

*M. **ophione**, Gray (*Lamellaria*), P.Z.S., 1849, p. 169.
Circular Head, *R. Tate*; George Bay, *W. F. Petterd*.

Family CALYPTRÆIDÆ.

Genus Calyptræa, Lamarck, 1799.

*C. **pellucida**, Reeve, Conch. Icon., f. 2.
Frederick Henry Bay, *W. L. May.*

*C. **tomentosa**, Quoy & Gaimard, Voy. Astrolabe, t. 72, f. 1-5, 1835.
Trochus calyptræformis, Lamarck, 1822, non Solander = *C. Lamarckii*, Deshayes, [illegible]
Local (Census): common E. and S. Coasts, *W. L. May.*

Genus CREPIDULA, Lamarck, 1799.

*C. UNGUIFORMIS, Lamarck, 1822; Reeve, Conch. Icon., t. 1, f. 1. 1859.
C. immersa, Angas, P.Z.S., 1865, p. 57, t. 2, f. 12.
Typical (Coll. W. F. Petterd !); *C. immersa* (Coll. W. L. May).

*C. MONOXYLON, Lesson, Voy. Coquille, ii., p. 391, 1830.
C. contorta, Quoy & Gaimard, Voy. Astrolabe, t. 72, f. 15-16.
Frederick Henry Bay, *W. L. May*.

Genus CAPULUS, Montfort, 1810.

*C. VIOLACEUS, Angas, P.Z.S., 1867, p. 114, t. 13, f. 23.
Frederick Henry Bay, *W. L. May*.

Family HIPPONYCIDÆ.

Genus HIPPONYX, Defrance, 1819.

*H. AUSTRALIS, Lamarck (*Patella*), 1819; *H. australis*, Quoy & Gaimard, Voy. Astrolabe, iii., p. 434, t. 72, f. 25-34, 1835.
Amalthea conica, Schumacher, 1817, t. 21, f. 4.
Common (Census); King Island, *R. Tate*.

*H. ANTIQUATA, Linné (*Patella*), 1766; *H. foliacea*, Quoy & Gaimard, Voy. Astrolabe, iii., p. 439, t. 72, f. 41-45.
Loc. ? (Census); King Island, *R. Tate;* general, *W. L. May*.

*H. DANIELI, Crosse (*Capulus*), Rev. Zool., 1858, p. 161, t. 3, f. 2; *H. Danieli*, Crosse, Journ. de Conch., 1862, p. 19.
Tamar Heads, plentiful (Census), *W. F. Petterd* !; King Island !.

Family VERMETIDÆ.

Genus THYLACODES, Mörch, 1862.

*T. SULCATUS, Lamarck (*Serpula*), 1818.
Vermetus arenarius, Quoy & Gaimard, Voy. Astrolabe, t. 67, f. 8-10, p. 289, non Lamarck.
Common in Bass Straits (Census); D'Entrecasteaux Channel off Pilot Station, *W. L. May*.

*T. (?) CAPERATUS, Tate & May, T.R.S.S. Aust., xxiv., p. 94, 1900. (Pl. xxiii., fig. 14).
Tamar Heads, *W. F. Petterd* !.

Genus SILIQUARIA, Bruguière, 1789.

Tenagodus, Guettard, 1770.

*S. AUSTRALIS, Quoy & Gaimard, Voy. Astrolabe, iii., p. 302. Common (Census).

S. lactea, Lamarck; Man. Conch., viii., p. 191, pl. lviii., f. 26.

*S. WELDII, Ten.-Woods (*Tenagodus*), P.R.S.Tasm., 1876, p. 144; Tryon, Man. Conch., viii., t. 58, f. 28, 1886.

E. Coast, somewhat common (Census); Frederick Henry Bay, *W. L. May.*

Family TURRITELLIDÆ.

Genus TURRITELLA, Lamarck, 1799.

*T. AUSTRALIS, Lamarck, 1822, Kiener, Iconog., t. 4, f. 3.

T. granulifera, Ten.-Woods, P.R.S.Tasm., 1876, p. 143.

Port Arthur, somewhat common (type of *T. granulifera*); Pirate's Bay, *W. L. May.*

*T. LAMELLOSA, Watson, Journ.L.S., xv., 1880, p. 229; Challenger Exped., 1886, p. 476, t. 39, f. 6.

T. acuta, Ten.-Woods, P.R.S.Tasm., 1876, p. 143; Tryon, Man. Conch., viii., p. 206, t. 64, f. 10 (non Mayer, 1868). =

T. oxyacris, Tate, T.R.S.S.Aust., xxi., p. 41, 1897.

Long Bay (type of *T. acuta*); D'Entrecasteaux Channel, *W. L. May.*

*T. SINUATA, Reeve, Conch. Icon., f. 62.

Port Esperance, *W. L. May.*

T. quadrata, Donald, Mal. Soc., iv., 1900, p. 53, t. 5, f. 8-8*b*.

Long Bay, common (Census).

*T. ATKINSONI, Tate & May, T.R.S.S.Aust., xxiv., 1900, p. 95. (Pl. xxiii., figs. 15-17).

T. Tasmanica, Ten.-Woods, P.R.S.Tasm., 1877, p. 140, non Reeve.

T. Tasmaniensis, Ten.-Woods, MS., *op. cit.*, 1878.

Long Bay (type of Ten.-Woods); Port Esperance, *W. L. May.*

*T. CLATHRATA, Kiener, Coq. Viv., t. 14, f. 1.

(Hobart Mus.?)

*T. **Gunni**, Reeve, Conch. Icon., f. 42, 1849.
Type, common (Census).

*T. **accisa**, Watson, Journ.L.S., 1880, p. 220; Challenger Exped., 1886, p. 476, t. 30, f. 4.
T. Higginsi, Petterd, Journ. Conch., 1884, p. 135.
Tamar Heads (type of *T. Higginsi* !).

Family SCALARIIDÆ.

Genus Scalaria, Lamarck, 1801.

*S. **aculeata**, Lamarck, 1819; Sowerby, Thes. Conch., f. 35-36.
Common (Census); King Island !.

*S. **jukesiana**, Forbes, Voy. Rattlesnake, p. 383, f. 7.
S. delicatula, Crosse & Fischer, Journ. de Conch., 1864, p. 347; 1865, p. 42, t. 3, f. 9-10.
Loc. ? (Census); S. and E. Coasts, *W. L. May;* King Island !.

*S. **australis**, Lamarck, 1819; Delessert, Recueil, t. 33, f. 4.
Common (Census).

*S. **granosa**, Quoy & Gaimard (*Turritella*), Voy. Astrolabe, iii., p. 138, t. 55, f. 29-30.
Bass Straits (Census); E. Coast, *W. L. May;* King Island.

*S. **tenella**, Hutton, P.L.S.N.S.W., ix., 1885, p. 943.
S. lineolata, Ten.-Woods, non Kiener.
N. Coast, rare (Census); (Hobart Mus. !).

*S. **minutula**, Tate & May, T.R.S.S.Aust., xxiv., 1900, p. 95. (Pl. xxv., fig. 41).
Type ! (Hobart Mus.).

S. **pyramidalis**, Sowerby, P.Z.S., 1844, p. 2; Thes. Conch., f. 4.
N. Coast, *W. F. Petterd.*

S. **varicosa**, Lamarck, Sowerby, Conch. Icon., xix., t. ii., f. 12.
Bass Straits, *J. H. Gatliff.*

Genus Crosseia, A. Adams, 1855.

*C. **labiata**, Ten.-Woods, P.R.S.Tasm., 1876, p. 151; Hedley, P.L.S.N.S.W., 1900, p. 500, pl. xxvi., f. 18.
Long Bay (type); D'Entrecasteaux Channel, *W. L. May.*

*C. CANCELLATA, Ten.-Woods, P.R.S.Tasm., 1878, p. 122. (Pl. xxiii., fig. 1).

Delphinula Johnstoni, Beddome, P.R.S.Tasm., 1882, p. 31, and 1883, p. 169.

Blackman's Bay (type); D'Entrecasteaux Channel, *Beddome;* Long Bay, *W. L. May.*

*C. CONCINNA, Angas, P.Z.S., 1867, t. 44, f. 14.

Kelso, Tamar River, *Beddome.*

Family SOLARIIDÆ.

Genus SOLARIUM, Lamarck, 1799.

*S. REEVEI, Hanley, P.Z.S., 1862, p. 204; Sowerby, Thes. Conch., iii., f. 9-10.

E. Coast, *W. L. May.*

Section *Philippia*, Gray, 1840.

*S. LUTEUM, Lamarck, vii., p. 5, 1822; Hanley, Thes. Conch., iii., f. 53-54; Delessert, Recueil, t. 34, f. 2.

Loc. ?(Census); Storm Bay, *W. L. May.*

Family EULIMIDÆ.

Genus EULIMA, Risso, 1826.

*E. AUGUR, Angas, P.Z.S., 1865, p. 56; Reeve, Conch. Icon., 1866, f. 47.

E. proxima, Sowerby, in Reeve's Conch. Icon., t. 6, f. 48, 1866.

N. Coast only, *W. L. May.*

*E. APHELES, Ten.-Woods, P.R.S.Tasm., 1879, p. 40. (Text fig. 5).

Circular Head (type).

*E. TENISONI, Tryon, Man. Conch., viii., 1886, p. 269, non t. 98, f. 16. (Pl. xxv., fig. 60).

E. micans, Ten.-Woods, P.R.S.Tasm., 1876, p. 144 non Carpenter.

Long Bay (type! in Hobart Mus.); Brown River, *W. F. Petterd!*; Frederick Henry Bay, very rare, *W. L. May.*

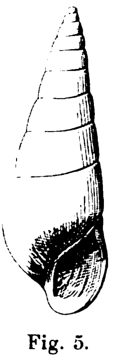


Fig. 5.
E. apheles.

*E. **Tryoni**, Tate & May, T.R.S.S.Aust., xxiv., p. 96, 1900.

E. Tenisoni (pars), Tryon, *op. cit.*, t. 68, f. 16, non p. 269; Tate T.R.S.S.Aust., xxii., 1898, p. 81.

Derwent Estuary, *W. L. May;* common in S. Australia.

*E. **orthopleura**, Tate, T.R.S.S.Aust., xxii., 1898, p. 80, t. 4, f. 1. *W. L. May.*

*E. **indiscreta**, Tate, T.R.S.S.Aust., xxii., 1898, p. 82, t. 4, f. 3.

E. Petterdi, Beddome, P.R.S.Tasm., 1883, p. 168.

Frederick Henry Bay, *W. L. May;* Blackman's Bay, *Beddome.*

*E. **rosea**, Pease(?), P.Z.S., 1860, p. 437; Reeve, Conch. Icon., f. 39.

Brown River, *W. F. Petterd*!.

*E. **inflata**, Tate & May, T.R.S.S.Aust., xxiv., p. 95, 1900. (Pl. xxv., fig. 58).

N. Coast, *W. F. Petterd*!.

*E. **Mayii**, Tate, T.R.S.S.Aust., xxiv., 1900, p. 96. (Pl. xxv., fig. 50).

E. Coast, south of Swansea, *W. L. May.*

Section *Subularia*, Monterosato, 1884.

Leiostraca, H. & A. Adams.

*E. **bivittata**, Reeve, Conch. Icon., Mon. *Leiostraca*, f. 6.

E. vitrea, Petterd, Journ. Conch., 1884, p. 136, non Adams, 1854.

Tamar Heads, *W. F. Petterd*!.

Section *Mucronalia*, A. Adams, 1862.

*E. **mucronata**, Sowerby, in Reeve's Conch. Icon., Mon. *Eulima*, f. 42.

Frederick Henry Bay, *W. L. May;* *W. F. Petterd*!.

Genus **Stylifer**, Broderip, 1832.

*S. **marginata**, Ten.-Woods (*Eulima*), P.R.S.Tasm., 1878, p. 40 (immature and imperfect).

S. Lodderæ, Petterd, Journ. Conch., 1884, p. 140; Hedley, P.L.S.N.S.W., xxv., 1900, p. 92 (woodcut after type).

Circular Head (type !), *W. F. Petterd;* N.W. Coast (type of *S. Lodderæ*, adult and perfect).

*S. PETTERDI, Tate & May, T.R.S.S.Aust., xxiv., 1900, p. 96; Hedley, P.L.S.N.S.W., xxv., p. 729, f. 27, 1901.

S. robusta, Petterd, Journ. Conch., 1884, p. 140; *S. tumida*, Braz., MS., non Pease, 1860.

Leven Heads (type).

Family PYRAMIDELLIDÆ.

Genus SYRNOLA, A. Adams, 1860.

*S. BIFASCIATA, Ten.-Woods, P.R.S.Tasm., 1876, p. 145.

Obeliscus jucundus, Angas, P.Z.S., 1877, p. 173, t. 26, f. 10.

Long Bay (type); S. Coast, *W. L. May.*

*S. TINCTA, Angas, P.Z.S., 1871, p. 15, t. 1, f. 11.

S. Michaeli, Ten.-Woods, P.R.S.Tasm., 1877, p. 150.

N. Coast, *Ten.-Woods.*

*S. TASMANICA, Ten.-Woods (*Styloptygma*), P.R.S. Tasm., 1877, p. 151.

Blackman's Bay (type); Frederick Henry Bay, *W. L. May.*

*S. PETTERDI, Tate & May, T.R.S.S.Aust., xxiv., 1900, p. 97. **(Pl. xxv., fig. 37).**

***Obeliscus Tasmanicus*, Petterd, Journ. Conch., 1884, p. 40, non** *S. Tasmanica*, Ten.-Woods (*Styloptygma*), 1877.

Odostomia Petterdi, Gatliff, Vict. Nat., xvii., p. 54, 1900.

N. Coast (type !).

S. MICRA, Pritchard & Gatliff (sp.). **(Pl. xxv., fig. 53).**

Turbonilla (Ondina) micra, Pritch. & Gat., P.R.S.Vict. xiii., 1900, p. 134, t. xxi., f. 1.

Syrnola punctospira, Tate & May, T.R.S.S.Aust., xxiv., p. 97.

George Bay, *W. F. Petterd* (type of *punctospira*).

*S. HARRISSONI, Tate & May, T.R.S.S. Aust., xxiv., 1900, p. 96. **(Pl. xxv., fig. 54).**

Off Brown's River, *E. Harrisson* (Coll. W. L. May).

Genus ODONTOSTOMIA, Fleming, em., 1828.

*O. ANGASI, Tryon, Man. Conch., viii., 1886, p. 362, t. 79, f. 68.

O. lactea, Angas, P.Z.S., 1867, t. 13, f. 11, non Dunker.

*O. **DEPLEXA**, Tate & May, T.R.S.S.Aust., xxiv., 1900, p. 97. (Pl. xxv., fig. 45).
Frederick Henry Bay, *W. L. May;* also Victoria, *J. Gatliff* !, and South Australia, *R. Tate*.

*O. **METCALFEI**, Pritchard & Gatliff, P.R.S.Vict., xiii., 1900, p. 136, t. 21, f. 3.
W. L. May; common in S. Australia, *R. Tate;* King Island !.
O. eburnea, Metcalfe MS.

O. **TASMANICA**, Ten.-Woods, P.R.S.Tasm., 1876, p. 29. (Pl. xxiii., fig. 4).
Long Bay (type).

Section *Pyrgulina*, A. Adams, 1863.

*O. **AUSTRALIS**, Angas, P.Z.S., 1871, p. 15, t. 1, f. 9.
W. L. May.

*O. Mayii, Tate, T.R.S.S.Aust., xxii., 1898, p. 84, t. 4, f. 6.
Frederick Henry Bay (type).

*O. **SUPRASCULPTA**, Ten.-Woods (*Rissoina*), P.R.S.Vict., 1877, p. 57. (Pl. xxv., fig. 53; Pl. xxvi., fig. 68..
O. varians, Tate & May, T.R.S.S.Aust., xxiv., 1900, p. 97.
Kinghorn Point in D'Entrecasteaux Channel, *E. Harrisson ;* Long Bay (type).

Section *Oscilla*, A. Adams, 1867.

*O. **LIGATA**, Angas, P.Z.S., 1877, p. 173, t. 26, f. 11.
Parthenia Tasmanica, Ten.-Woods, P.R.S.Tasm., 1877, p. 150.
Long Bay, *Ten.-Woods;* D'Entrecasteaux Channel, *W. L. May.*

Section *Parthenia*, Lowe, 1840.

*O. **VINCENTIANA**, Tryon, Man. Conch., viii., p. 362, t. 79, f. 12.
P. gracilis, Angas, P.Z.S., 1878, p. 862, t. 44, f. 9, non Pease.
(Coll. W. F. Petterd !).

Genus EULIMELLA, Forbes, 1846.

*E. **AURANTIACA**, Angas, P.Z.S., 1867, p. 112, t. 13, f. 4. (Pl. xxv., fig. 57).
E. aurantia, Petterd (*Eulima*), Journ. Conch., 1884, 144.
North Coast (type !).

*E. TURRITA, Petterd (*Aclis*), Journ. Conch., 1884, p. 140. (Pl. xxv., fig. 38).
N. Coast and isles in Bass Straits, *W. F. Petterd* !.

*E. MICRA, Petterd (*Aclis*), Journ. Conch., 1884, p. 136. (Pl. xxv., figs. 43, 44).
N. Coast and isles in Bass Straits, *W. F. Petterd* !.

*E. NODULARIS, Tate & May.

Genus PSEUDORISSOINA, Tate & May, 1900.

*P. Tasmanica, Ten.-Woods (*Stylifer*), P.R.S.Tasm., 1877, p. 152; *S. Tasmanica*, Tryon, Man. Conch., viii., p. 293, t. 71, f. 61 (indifferent). (Pl. xxv., figs. 55, 56).
Rissoia Tasmanica, Tate, T.R.S.S.Aust., xxiii., p. 233, 1899.
Blackman's Bay (type !).

Genus TURBONILLA, Risso, 1826.

*T. ADMIRANDA, Tate & May, T.R.S.S.Aust., xxiv., 1900, p. 98.
Elusa bifasciata, Ten.-Woods, P.R.S.Tasm., 1877, p. 150; non *T. bifasciata*, H. Adams, 1861.
T. festiva, Angas, P.Z.S., 1877, p. 35, t. 5, f. 4; non Folin, 1867.
Blackman's Bay, *Ten.-Woods*; S. Coast, *W. L. May*.

*T. FUSCA, A. Adams (*Chemnitzia*), P.Z.S., 1853, p. 181; Tryon, Man. Conch., viii., p. 334, t. 76, f. 46.
T. erubescens, Tate, T.R.S.S.Aust., ii., 1879, p. 138, t. 5, f. 10.
Blackman's Bay, *W. F. Petterd* !.

*T. HOFMANI, Angas, P.Z.S., 1877, p. 183.
T. nitida, Angas, P.Z.S., 1867, p. 112, non A. Adams.
T. Angasi, Ten.-Woods, P.R.S.Tasm., 1878, p. 34.
Long Bay, *Ten.-Woods*; King Island, *R. Tate*; general, *W. L. May*.

*T. ACICULARIS, Adams, P.Z.S., 1853, p. 182.
T. Macleayana, Ten.-Woods, P.R.S.Tasm., 1877, p. 151; Tryon, Man. Conch., viii., p. 334, t. 76, f. 44.
Long Bay (type !).

*T. **MARIÆ**, Ten.-Woods, P.R.S.Tasm., 1876, p. 144; Tryon, Man. Conch., viii., t. 76, f. 42.

King Island (type !, common).

*T. **BEDDOMEI**, Petterd (*Chemnitzia*), Journ. Conch., 1884, p. 136.

T. crenulifera, Tate, T.R.S.S.Aust., xv., 1892, p. 126, t. 1, f. 2.

N.W. Coast (type); Frederick Henry Bay, *W. L. May*.

Section *Pyrgostylus*, Monterosato, 1884.

*T. **VARICIFERA**, Tate, T.R.S.S.Aust., xxii., 1898, p. 85, t. 4, f. 7.

Pirate's Bay, *W. L. May*.

Genus CINGULINA, A. Adams, 1860.

*C. **SPINA**, Crosse & Fischer (*Turritella*), Journ. de Conch., 1864, p. 347; 1865, t. 3, f. 12-14, p. 44.

Aclis tristriata, Ten.-Woods, P.R.S.Tasm., 1877, p. 150 (var. major).

N.W. Coast (Ten.-Woods' type); Frederick Henry Bay, *W. L. May*.

Family CERITHIOPSIDÆ.

Genus CERITHIOPSIS, Forbes & Hanley, 1849.

*C. **MINIMA**, Ten.-Woods (*Bittium*), P.R.S.Tasm., 1878, p. 123; id., descrip. emend., 1879, p. 37; Hedley, P.L.S.N.S.W., xxv., 1901, p. 722, f. 20.

Blackman's Bay (type) and N. Tasmania, *Ten.-Woods*; D'Entrecasteaux Channel, *W. L. May*.

*C. **TURBONILLOIDES**, Ten.-Woods (*Bittium*), P.R.S.Tasm., 1879, p. 39. (Text fig. 6).

Circular Head (type); Frederick Henry Bay, *W. L. May*.

C. **SEMILÆVIS**, Ten.-Woods (*Bittium*), P.R.S.Vict., 1877, p. 58.

N.W. Tasmania (unique type in Nat. Mus. Melbourne).

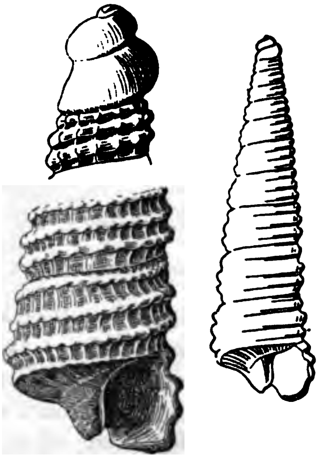


Fig. 6—*C. turbonilloides*.

*C. ANGASI, Semper, Cat. Mus. Godeffroy, p. 108, 1874.
C. clathrata, Angas, P.Z.S., 1871, p. 16, t. 1, f. 12 *(nom. præocc.)*.
D'Entrecasteaux Channel, *W. L. May* (Coll. W. F. Petterd !).

*C. CROCEA, Angas, P.Z.S., 1871, p. 16, t. 1, f. 13.
C. Atkinsoni, Ten.-Woods, P.R.S.Tasm., 1876, p. 139.
C. Johnstoni, Petterd, Journ. Conch., 1884, p. 142.
Long Bay !, *Ten.-Woods;* Circular Head, Tamar Heads, &c., *W. F. Petterd.*

*C. ALBOSUTURA, Ten.-Woods, P.R.S.Tasm., 1877, p. 12.
C. purpurea, Angas, P.Z.S., 1877, p. 36, t. 5, f. 7, non Carpenter.
Islands in Bass Straits, *Ten.-Woods;* King Island, *R. Tate;* Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May.*

Family CERITHIIDEÆ.

Genus CERITHIUM, Bruguière, apud Adanson, 1757.

*C. DUBIUM, Sowerby, Thes. Conch. sp. 62; Reeve, Conch. Icon., f. 78.
C. monachus, Crosse, Journ. de Conch., 1864; 1865, t. 3, f. 17, p. 45.
C. eludens, Bayle (*nom. mut.*), 1880.
Type of *C. dubium;* common (Census); King Island, *R. Tate.*

*C. ICARUS, Bayle (*nom. mut.*), 1880.
C. tenue, Sowerby, Thes. Conch., f. 212; Reeve, t. 18, f. 130, non Deshayes.
Bittium variegatum, Brazier, P.L.S.N.S.W., 1894, p. 172, t. 14, f. 9.
N. Coast, *W. L. May.*

Genus ATAXOCERITHIUM, Tate, 1893.

*A. SEROTINUM, Adams (*Cerithium*) in Sowerby's Thes., f. 102; Reeve, Conch. Icon., f. 146.
C. rhodostoma, Adams, *op. cit.*
Types of both forms from Tasmania; not common (Census); E. and S. Coasts, rare, *W. L. May;* King Island !.

Genus BITTIUM, Gray, 1847.

*B. GRANARIUM, Kiener (*Cerithium*), Coq. Viv., p. 72, t. 19, f. 3; Reeve, Conch. Icon., f. 35.

Common (Census); S. Coast, *W. L. May;* King Island!.

*B. LAWLEYANUM, Crosse, Journ. de Conch., 1863, p. 87, t. 1, f. 4.

Cerithium insculptum, Sowerby, in Reeve's Conch. Icon., f. 128, 1865.

Blackman's Bay, *W. L. May.*

*B. CYLINDRICUM, Watson, Challenger Exped., p. 550, t. 39, f. 5.

S. Coast, *W. L. May.*

*B. ESTUARINUM, Tate, T.R.S.S.Aust., xvii., 1893, p. 190, t. 5, f. 12.

Ralph Bay, *W. L. May* (Coll. Aug. Simson !).

Genus POTAMIDES, Brongniart, 1810.

Subgenus PYRAZUS, Montfort, 1810.

*P. EBENINUS, Bruguière (*Cerithium*), Quoy & Gaimard, Voy. Astrolabe, t. 55, f. 1-3.

Frederick Henry Bay (rare), *W. L. May.*

Subgenus BATILLARIA, Benson, 1842.

Lampania, Gray, 1846.

*B. DIEMENENSIS, Quoy & Gaimard (*Cerithium*), Voy. Astrolabe, t. 55, f. 11-13, p. 128.

Turritella cerithium, Q. & G., *op. cit.*, t. 55, f. 27-28, p. 139.

Bittium turritella, Ten.-Woods, 1877.

Batillaria cerithium, Tate, T.R.S.S.Aust., xxi., 1897, p. 42.

Hobart (type); very common (Census).

*B. AUSTRALIS, Quoy & Gaimard (*Cerithium*), *op. cit.*, t. 55, f. 7.

Common (Census).

Genus TRIFORIS, Deshayes, 1824.

*T. FESTIVA, A. Adams, P.Z.S., 1851, p. 278.

(Colls. Miss Lodder and W. L. May).

*T. PFEIFFERI, Crosse & Fischer, Journ. de Conch., 1865, p. 47, t. 1, f. 14-15.
(Colls. Miss Lodder and W. L. May).

*T. TASMANICA, Ten.-Woods, P.R.S.Tasm., 1876, p. 28; Tryon, Man. Conch., ix., p. 184, t. 38, f. 31. (Text fig. 7).
Long Bay (type); Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May.*

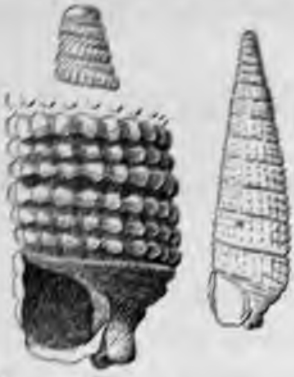


Fig. 7—*T. Tasmanica.*

*T. FASCIATA, Ten.-Woods, P.R.S. Tasm., 1879, p. 34. (Pl. xxiii., figs. 10, 11).
Circular Head (type); Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May;* King Island !.

*T. ANGASI, Crosse & Fischer, Journ. de Conch., 1865, p. 46, t. 1, f. 12-13.
Hobart Mus. ! (Miss Lodder).

Family LITIOPIDÆ.

Genus DIALA, A. Adams, 1861.

*D. LAUTA, A. Adams, Ann. Mag. Nat. Hist., 1862, p. 298; Tryon Man. Conch., ix., t. 53, f. 83.
D. punctata, Ten.-Woods, P.R.S.Tasm., 1876, p. 147.
D'Entrecasteaux Channel, very common, *Ten.-Woods;* S. Coast, common, *W. L. May.*

*D. MONILE, A. Adams (*Alaba*), *op. cit.*, p. 297.
D. tessellata, Ten.-Woods, P.R.S.Tasm., 1876, p. 147.
Rissoina St. Clarœ, Ten.-Woods, P.R.S.Tasm., 1877, p. 154.
Var. *pagodula,* A. Adams, *op. cit.*, p. 297.
Rissoina Flindersi, Ten.-Woods, P.R.S.Tasm., 1877, p. 154.
Common, *Ten.-Woods.*

*D. PICTA, A. Adams, *op. cit.*, 1861, p. 243; 1862, p. 295.

Family LITTORINIDÆ.

Genus LITTORINA, Férussac, 1821.

*L. **MAURITIANA**, Lamarck (*Phasianella*), An. s. Vert., vii., p. 54, 1822.
L. unifasciata, Gray; Reeve, Conch. Icon., f. 100.
Var. *L. Diemenensis*, Quoy & Gaimard, Voy. Astrolabe, ii., p. 479, t. 33, f. 8-11, 1833.
L. paludinella, Reeve, Conch. Icon., f. 84.
L. Philippi [Carpenter], Ten.-Woods & Angas.
Type of *L. Diemenensis*; common (Census); King Island, *R. Tate.*

Genus TECTARIA, Valenc., 1833.

T. **NODULOSA**, Gmelin sp.
Littorina pyramidalis, Quoy & Gaimard, Voy. Astrolabe, 1833, p. 482, t. 33, f. 12-15.
Hobart Mus.

Genus RISELLA, Gray, 1840.

*R. **MELANOSTOMA**, Gmelin (*Trochus*).
R. melanostoma, Crosse, Journ. de Conch., 1864, t. 11, f. 1.
Very common (Census); King Island, *R. Tate.*

*R. **NANA**, Lamarck (*Trochus*), 1822
Trochus nanus, Quoy & Gaimard, Voy. Astrolabe, t. 62, f. 5-7, p. 273; Delessert, Recueil, 1841, t. 36, f. 4.
T. luteus, Quoy & Gaimard, *op. cit.*, p. 271, t. 62, f. 8-11.
Type of *T. nanus*, Q. & G.; Storm Bay, *W. L. May.*

*R. **PLANA**, Quoy & Gaimard (*Trochus*), *op. cit.*, p. 275, t. 62, f. 13-14.
T. auratus, Q. & G.. *op. cit.*, p. 276, t. 62, f. 15-19.
D'Entrecasteaux Channel (type of *R. aurata*); common on N. Coast (Census); Norfolk Bay, *W. L. May.*

Genus FOSSARINA, Adams & Angas, 1863.

F. **FUNICULATA**, Ten.-Woods, P.R.S.Vict., xvii., 1881, p. 81. t. 1, f. 6-7; Tryon, Man. Conch., ix., p. 275, t. 52, f. 18-19 (copied). (Pl. xxiii., fig. 9).
Type, Victoria.

Family FOSSARIDÆ.

Genus Fossarus, Philippi, 1841.

*F. BULIMOIDES, Ten.-Woods, P.R.S.Tasm., 1877, p. 148. (Pl. xxvi., fig. 66).
Long Bay (type); Frederick Henry Bay, *W. L. May*.

*F. MINUTA, Petterd (*Crosseia*), Journ. Conch., 1884, p. 139 (Pl. xxvii., fig. 85).
Blackman's Bay (type !).

Family ADEORBIIDÆ.

Genus Adeorbis, S. Wood, 1842.

*A. ANGASI, A. Adams, P.Z.S., 1863, p. 424, t. 37, f. 11-12.
Pirate's Bay, *W. L. May*.

*A. VINCENTIANA, Angas, P.Z.S., 1880, p. 417, t. 50, f. 9.
Frederick Henry Bay and Pirate's Bay, *W. L. May;* Don Heads, near Devenport, *W. F. Petterd* !.

Family TRUNCATELLIDÆ.

Genus Truncatella, Risso, 1826.

*T. SCALARIANA, Cox, Aust. Land Shells, 1867, p. 93, t. 15, f. 10.
T. Tasmanica, Ten.-Woods, P.R.S.Tasm., 1876, p. 143.
Turbonilla Tasmanica, Ten.-Woods, *op. cit.*, 1876, p. 145.
Bass Straits (Census); N. and E. Coasts, *W. F. Petterd*.

*T. MARGINATA, Küster, Mon., p. 12, f. 24-26; Cox, Aust. Land Shells, p. 92, t. 15, f. 8*a-b*.
Bass Straits (Census).

Genus Coxiella, E. A. Smith, 1898.

Blanfordia, Cox, 1867, non Adams, 1863.

*C. CONFUSA, E. A. Smith, Mal. Soc., iii., p. 76, 1898.
Blanfordia striatula, Cox, Aust. Land Shells, 1867, t. 15, f. 13; non Menke.
Clarence Plains, *Ten.-Woods;* Badger Island, *R. M. Johnston* !; near Hobart, *W. L. May*.

Family RISSOIDÆ.

Genus Rissoia, Fremenville, 1814.

*R. APICILIRATA, Tate & May, T.R.S.S.Aust., xxiv., p. 99, 1900. (Pl. xxvi., fig. 61).
D'Entrecasteaux Channel, *W. L. May.*

*R. DEMESSA, Tate & May, T.R.S.S.Aust., xxiv., p. 98, 1900. (Pl. xxiv., fig. 18; Pl xxvi., fig. 72).
Frederick Henry Bay, *W. L. May.*

*R. DISCREPANS, Tate & May, T.R.S.S.Aust., xxiv., p. 99, 1900. (Pl. xxvi.. fig. 65).
D'Entrecasteaux Channel, *W. L. May.*

*R. INCIDATA, Dunker, Novara Exped., t. 1, f. 19, 1866.
Frederick Henry Bay, *W. L. May.*

*R. BICOLOR, Petterd, Journ. Conch., 1884, p. 137. (Pl. xxvi., fig. 63).
N. Coast (type); Derwent Estuary, *W. L. May.*

*R. DUBITABILIS, Tate, T.R.S.S.Aust., xxiii., p. 232, 1899. (Pl. xxvi., fig. 71).
R. dubia, Petterd, Journ. Conch., 1884, p. 37; non Defrance.
Tamar Heads (type !).

*R. OLIVACEA, Dunker, Novara Exped., t. 2, f. 14.
R. Diemenensis, Petterd, Journ. Conch., 1884, p. 138.
Table Cape and Tamar Heads, *W. F. Petterd* !; Frederick Henry Bay, *W. L. May.*

*R. TUMIDA, Ten.-Woods (*Diala*), P.R.S.Tasm., 1876, p. 147. (Pl. xxvi., fig. 67).
Rissoina Kershawi, Ten.-Woods, P.R.S.Vict., 1877, p. 57.
Swansea (type); Long Bay, *W. F. Petterd* !, type of *R. Kershawi.*

*R. DISSIMILIS, Watson (*Eulima*), Challenger Exped., p. 532, t. 37, f. 5.
Eulima Tasmanica, Ten.-Woods, P.R.S.Tasm., 1876, p. 27, non *R. Tasmanica*, Tate, 1899.
Rissoina cylindracea, Ten.-Woods, P.L.S.N.S.W. 1877, p. 266, non Krynicki, 1837 = *R. ischna*, Tate, 1899.
Long Bay, *Ten.-Woods;* Derwent Estuary, *W. L. May.*

*R. Simsoni, Tate & May, T.R.S.S.Aust., xxiv., p. 100, 1900. (Pl. xxvi., fig. 76).
Derwent Estuary, *W. L. May;* also Port Fairy, Vict., *Rev. T. Whan.*

*R. Petterdi, Brazier, P.L.S.N.S.W., 1895, p. 697. (Pl. xxvi., fig. 73).
R. pulchella, Petterd, Journ. Conch., 1884, p. 138, non Risso.
N. Coast and isles in Bass Straits, *W. F. Petterd!;* Frederick Henry Bay, *W. L. May.*

*R. cyclostoma, Ten.-Woods, P.R.S.Tasm., 1877, p. 152; Tryon, Man. Conch., ix., p. 344, t. 71, f. 8.
Long Bay and Blackman's Bay (types, incl. var. *rosea*); S Coast, common, *W. L. May.*

*R. Verconis, Tate, T.R.S.S.Aust., xxiii., p. 233, 1899 (*nom. mut.*). (Pl. xxvii., fig. 86).
R. badia, Petterd, Journ. Conch., 1884, p. 138.
N. Coast and isles in Bass Straits, *W. F. Petterd!;* Frederick Henry Bay, *W. L. May.*

*R. Hulliana, Tate, Hand List S. Aust. Moll., p. 7, 1893 (*nom. mut.*). (Pl. xxvi., fig. 62).
R. fasciata, Ten.-Woods, P.R.S.Tasm., 1876, p. 146; 1877, p. 152; non Requien, 1848.
Bass Straits (type); King Island, *R. Tate;* S. Coast, *W. L. May.*

*R. Strangei, Brazier, P.L.S.N.S.W., 1894, p. 173, t. 14, f 11; 1895, p. 695.
R. lineata, Petterd, Journ. Conch., 1884, p. 137.
N. Coast (Petterd's type!); Frederick Henry Bay, *W. L. May.*

R. Baynstoni, Beddome, P.R.S.Tasm., 1883, p. 168.
D'Entrecasteaux Channel type).

*R. cheilostoma, Ten.-Woods, P.R.S.Tasm., 1877, p. 152; Tryon, Man. Conch., ix., p. 366, t. 68, f. 31.
Long Bay (type); S. Coast, *W. L. May.*

*R. Agnewi, Ten.-Woods, P.R.S.Tasm., 1877, p. 152 (Pl. xxvi., fig. 70).

R. Layardi, Petterd, Journ. Conch., 1884, p. 138.

Blackman's Bay (type); N. Coast (type of *R. Layardi* !); Frederick Henry Bay, *W. L. May*.

*R. **Tenisoni**, Tate, T.R.S.S.Aust., xxiii., p. 233, 1899 (*nom. mut.*).

R. australis, Ten.-Woods, P.R.S.Tasm., 1876, p. 146; 1877, p. 51, non Sowerby; Hedley, P.L.S.N.S.W., 1900, p. 505, pl. xxv., f. 4.

Badger Island (type); King Island, *R. Tate;* E. and S. Coasts, very common, *W. L. May*.

*R. **Mariæ**, Ten.-Woods, P.R.S.Tasm, 1876, p. 147; Tryon, Man. Conch., ix., p. 354, t. 71, f. 9.

King Island (type); Frederick Henry Bay, *W. L. May*.

*R. **rubicunda**, Tate & May, T.R.S.S.Aust., xxiv. p. 100, 1900.

Derwent River Estuary, *W. L. May*.

*R. **melanochroma**, Tate, T.R.S.S.Aust., xxiii,, 1899, p. 234.

R. melanura, Ten.-Woods, P.R.S.Tasm., 1877, p. 153; Tryon, Man. Conch., ix., p. 358, t. 7, f. 7, non *melanura*, C. B. Adams.

Blackman's Bay (type); Don Heads, *W. F. Petterd* !; Frederick Henry Bay, *W. L. May;* King Island !.

*R. **approxima**, Petterd, Journ. Conch., 1844, p. 138. (Pl. xxvi., fig. 69).

Tamar Heads (type !); Frederick Henry and Pirate's Bays, *W. L. May;* King Island !.

*R. **mixta**, Tate, T.R.S.S.Aust., xxiii., p. 234, 1899.

R. ochroleuca, Brazier, P.L.S.N.S.W., 1894, p. 174, t. 14, f. 11; non Brusina, 1869.

N.W. Coast, *W. F. Petterd* !; D'Entrecasteaux Channel, *W. L. May*.

*R. **Beddomei**, Tate, T.R.S.S.Aust., xxiii., p. 239, 1899. (Pl. xxvi., fig. 64).

R. flamia, Beddome, P.R.S.Tasm., 1883, p. 169; non *flammea* Dunker.

Blackman's Bay (type); S. Coast, rare, *W. L. May*.

*R. ATKINSONI, Ten.-Woods, P.R.S.Tasm., 1877, p. 153; Tryon, Man. Conch., ix., p. 354, t, 71, f. 10.

Long Bay (type); Frederick Henry Bay, *W. L. May.*

*R. PEREXIGUA, Tate & May, T.R.S.S.Aust., xxiv., p. 100, 1900. (Pl. xxiii., fig. 5).

Rissoina minutissima, Ten.-Woods, P.R.S.Tasm., 1878, p. 122, non *Rissoa minutissima*, Michelin, "Gen. Rissoa."

*R. CONTABULATA, Dunker, Novara Exped., t. 2, f. 20*a-b*.

Frederick Henry Bay, *W. L. May.*

*R. UNILIRATA, Ten.-Woods (*Rissoina*), P.R.S.Tasm., 1878, p. 123. (Pl. xxvi., fig. 79).

Blackman's Bay (type).

*R. PELLUCIDA, Tate & May, T.R.S.S.Aust., xxiv., p. 100, 1900. (Pl. xxiii., fig. 8).

Frederick Henry Bay, *W. L. May.*

Genus RISSOPSIS, Garrett, 1873.

*R. MACCOYI, Ten.-Woods (*Rissoa*), P.R.S.Tasm., 1877, p. 154; Hedley, P.L.S.N.S.W., 1900, p. 505, pl. xxvi., f. 11.

Long Bay and Blackman's Bay (type and co-type), Derwent Estuary, *W. L. May.*

*R. BULIMINOIDES Tate & May, T.R.S.S.Aust., xxiv., p. 101, 1900. (Pl. xxvi., fig. 75).

Frederick Henry Bay (10 fath.), *W. L. May.*

*R. CONSOBRINA Tate & May, T.R.S.S.Aust., xxiv., p. 101, 1900. (Pl. xxvii., fig. 94).

Frederick Henry Bay, common, *W. L. May.*

Genus RISSOINA, D'Orbigny, 1840.

*R. SPIRATA, Sowerby, Genera Shells, 1820-24, t. 208, f. 2; Schwartz, Rissoiden, f. 69.

King Island, *R. Tate.* S. and E. Coasts, *W. L. May.*

R. GERTRUDIS, Ten.-Woods, P.R.S.Tasm., 1876, p. 146; Tryon, Man. Conch., ix., p. 372, t. 55, f. 39.

King Island (type).

*R. **NIVEA**, A. Adams, P.Z.S., 1851, p. 265; Schwartz, Rissoiden, f. 10, 1860.
Common (Census).

*R. **VARIEGATA**, Angas, P.Z.S., 1867, p. 113, t. 13, f. 19.
Loc. ? (Census); King Island, *R. Tate;* Frederick Henry Bay, *W. L. May.*

*R. **HEDLEYI**, Tate, T.R.S.S.Aust., xxiii., 1899, p. 241, t. 7, f. 8.
W. L. May.

R. **EFFICATA**, Brazier, P.L.S.N.S.W., i., p. 366.
**R. semisculpta*, Tate, *loc. cit.*, p. 241, t. 7, f. 10.
Loc. ? (type).

*R. **FLEXUOSA**, Gould, Otia, p. 144; Reeve, Conch. Icon., f. 97.
R. turricula, Angas, P.Z.S., 1867, t. 13, f. 20.
Common (Census); Frederick Henry Bay, *W. L. May.*

R. **CINCTA**, Angas, P.Z.S., 1867, p. 114, t. 13, f. 22.
Rare (Census).

*R. **ELEGANTULA**, Angas, P.Z.S., 1880, p, 417, t. 40, f. 10.
Port Esperance, rare, *W. L. May.*

Family ASSIMINEIDÆ.

Genus ASSIMINEA, Fleming, 1828.

A. **BICINCTA**, Petterd, P.R.S.Tasm., 1889, p. 77, t. 2, f. 4.
Mouth of River Don (type).

A. **TASMANICA**, Ten.-Woods, P.R.S.Tasm., 1876, p. 79; Petterd, *loc. cit.*, t. 2, f. 2.
Rissoa Siennæ, Ten.-Woods, P.R.S.Tasm., 1877, p. 153.
Sorell (type of *A. Tasmanica*); N. Coast (type of *R. Siennæ*).

A. **AUSTRALIS**, Tate in Petterd, *op. cit.*, t. 3, f. 10.
Kelso, near mouth of River Tamar.

*A. **BRAZIERI**, Ten.-Woods (*Rissoa*), P.R.S.Tasm., 1876, p. 146.
Rissoa Brazieri, Tryon, Man. Conch., ix., p. 335, t. 71, f. 97.
Bruni Island (type); S. Coast, very common, *W. L. May.*

Family NERITIDÆ.

Genus NERITA, Lamarck, apud Adanson, 1757.

***N. MELANOTRAGUS, E. A. Smith, Alert Exped., p. 69, 1884.**
***N. atrata*, Reeve, Conch. Icon., f. 16, non Chemnitz.**
N. Coast (Census); King Island, *R. Tate;* general, but rare in the South, *W. L. May.*

Family CYCLOSTREMATIDÆ.

Genus CYCLOSTREMA, Marryatt, 1818.

***C. HARRIETTÆ, Petterd, Journ. Conch., 1884, p. 141; Tate, T.R.S.S.Aust., xxiii., p 215. (Pl. xxv., figs. 46, 47, 48).**
N.W. Coast (type !).

***C. JOHNSTONI, Beddome, P.R.S.Tasm., 1883, p 168; Tate, T.R.S.S.Aust., xxiii., p. 215, t. 7, f. 7*a-b*, 1899**
Brown's River (type !); Frederick Henry Bay, *W. L. May.*

***C. CHAROPA, Tate, *loc. cit.*, t. 7, f. 2*a-c*.**
***C. micra*, Petterd, Journ. Conch., 1884, p. 139, non Ten.-Woods, 1877.**
N. Coast and isles in Bass Straits, *W. F. Petterd* !; Frederick Henry Bay, *W. L. May.*

*C. INSCRIPTUM, Tate, T.R.S.S.Aust., xxiii., p. 216, t. 7, figs. 3 *a-b*.
Frederick Henry Bay, *W. L. May.*

*C. CONTABULATUM, Tate, *loc. cit.*, p. 222, t. 7, f. 6.
Frederick Henry Bay, *W. L. May.*

*C. MAYII, Tate, *loc. cit.*, p. 218, t. 6, f. 4*a-c*.
Frederick Henry Bay (type).

*C. ANGELI, Ten.-Woods (*Rissoa* ?), P R.S.Tasm., 1877, p. 153; 1878, p. 122; Tate, *loc. cit.*, p. 218; Hedley, P.L.S.N.S.W., 1900, p. 503, pl. xxv., f. 14.
Blackman's Bay (type); Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May.*

*C. CREBRESCULPTUM, Tate, *loc. cit.*, p. 219, t. 7, f. 5.
Rissoa Angeli, Tryon, Man. Conch., x., p. 358, t. 71, f. 11, non Ten.-Woods.

*C. AUSTRALE, Angas (*Cirsonella*), P.Z.S., 1877, p. 38, t. 5, f. 16.
C. (Tubiola) australe, Tate, *op. cit.*, p. 219. (Text fig. 8).
C. Weldii, Ten.-Woods, P.R.S.Tasm., 1877, p. 147.
C. Susonis, Ten.-Woods, *loc. cit.*, p. 147.
Long Bay (*C. Weldii*); N. Coast and Blackman's Bay, (*C. Susonis*); Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May*.

*C. PORCELLANUM, Tate & May, T.R.S.S. Aust., xxiv., p. 101, 1900. (Pl. xxvii., fig. 93).
Frederick Henry Bay, *W. L. May*.

*C. MICRON, Ten.-Woods, P.R.S.Tasm., 1877, p. 147; Tryon, Man. Conch., x., p. 95, t. 33, f. 13. (Pl. xxvii., fig. 91).
Long Bay (type); D'Entrecasteaux Channel, *W. L. May*.

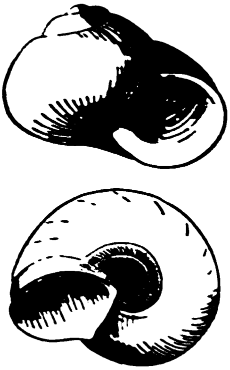


Fig. 8.
C. australe, var. *weldii*.

*C.? BRUNNIENSE, Beddome, P.R.S.Tasm., 1883, p. 168. (Text fig. 9).
Cloudy Bay (type); D'Entrecasteaux Channel, *W. L. May*.

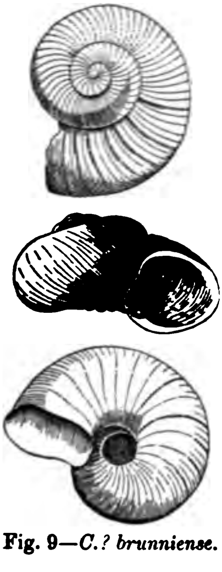


Fig. 9—*C.? brunniense*.

Genus LODDERIA, Tate, 1899.

*L. LODDERÆ, Petterd (*Liotia*), Journ. Conch., 1884, p. 135; Hedley, P.L.S. N.S.W., 1899, p. 802, woodcuts.
L. Lodderæ, Tate, T.R.S.S.Aust., xxiii., p. 222.
Leven Heads (type).

L. MINIMA, Ten.-Woods (*Liotia*), P.R.S. Vict., 1877, p 58; Petterd, Journ. Conch, ii. p. 88.
Lodderia minima, Hedley, P.L.S.N.S.W., xxv., p. 94, t. 3, f. 1-3, 1900.
Long Bay, *W. F. Petterd*.

Genus PSEUDOLIOTIA, Tate, 1898.

*P. MICANS !, A. Adams (*Cyclostrema*), P.Z.S., 1850; Sowerby, Thes. Conch., t. 255, f. 7 and 27.

Pseudoliotia micans, Tate, T.R.S.S. Aust., xxii, p. 339.

Liotia Angasi !, Crosse, Journ. de Conch., 1864, t. 13, f. 4.

Moderately plentiful at Pittwater (Census); D'Entrecasteaux Channel, *W. L. May*.

Family LIOTIIDÆ.

Genus LIOTIA, Gray, 1842.

*L. AUSTRALIS, Kiener (*Delphinula*), Iconog., t. 14, f. 7; Reeve, Mon. *Delphinula*, f. 30, 1843.

Rare (Census); N. Coast only, *W. L. May*.

*L. ANNULATA, Ten.-Woods, P.R.S.Tasm., 1878, p. 121; Tryon, Man. Conch., x, p. 111, t. 36, f. 30.

Blackman's Bay (type); Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May*.

*L. [illegible] Petterd, Journ. Conch., [illegible]

[illegible]

*L. [illegible] Hedley,

[illegible]

[illegible]

[illegible]

*L. [illegible] Tate,

[illegible] Pl. xxv, figs. [illegible]

[illegible]

[illegible] E. and S. Coasts,

W. L. May.

*L. [illegible] Tate, T.R.S.S. Aust., [illegible] p. 228.

Pl. xxv, fig. [illegible]

Off Pilot Station in D'Entrecasteaux Channel (type).

Family TURBINIDÆ.

Genus PHASIANELLA, Lamarck, 1804.

*P. AUSTRALIS, Gmelin.

P. tritonis, Chemnitz.

P. bulimoides, Lamarck, 1822.

P. venusta, Reeve, Conch. Icon., f. 2.

P. pulchella, Ten.-Woods, P.R.S.Tasm., 1877, p. 141 = *P. delicatula*, Ten.-Woods, 1878 = *P. australis* (juvenile).

Maria Island (type of *P. bulimoides*); common (Census).

*P. VENTRICOSA, Quoy & Gaimard, Voy. Astrolabe, ii., p. 237, t. 59, f. 8-9.

P. sanguinea, *P. zebra*, *P. venosa*, *P. reticulata*, all of Reeve, Conch. Icon., t. 3, are mere colour varieties.

King Island ! and Bass Straits (Census); N. Coast only, *W. L. May*.

P. VARIEGATA, Lamarck, 1822; Delessert, t. 37, f. 10.

P. Angasi, Crosse, Journ. de Conch., 1864, p. 344, t. 13, f. 5.

Rare (Census).

*P. ROSEA, Angas, P.Z.S., 1867, p. 114, t. 13, f. 24.

King Island, *R. Tate;* islands of Bass Straits and Blackman's Bay (Census); E. Coast, *W. L. May;* King Island !.

Genus TURBO, Linné, 1758.

Subgenus MARMOROSTOMA, Gray.

*T. UNDULATUS, Chemnitz, Conch. Cab.; Reeve, Conch. Icon,, f. 3.

T. Simsoni, Ten.-Woods, P.R.S.Tasm., 1877, p. 141 (juvenile).

Van Dieman's Land and New Holland (Chemnitz); common (Census); King Island !.

*T. GRUNERI, Philippi, Conch. Cab., ed. ii., p. 52, t. 12, f. 7.

T. circularis, Reeve, Conch. Icon., f. 46, 1848.

King Island (Census); Flinders Island, *R. M. Johnston* !.

Subgenus NINELLA, Gray.

T. STAMINEUS, Martyn, Univ. Conch., t. 71, 1784.

T. lamellosus, Reeve, Conch. Icon., f. 26.

N. Coast (Census).

Genus ASTRALIUM, Link, 1807.

***A. FIMBRIATUM, Lamarck (*Trochus*).**

***Carinidea fimbriata*, Swainson, P.R.S.Tasm., iii., for 1854, p. 39, t. 6, f. 3-4.**

***Turbo squamiferus*, Koch, in Philippi's Abbild., i., 1844, p. 138, t. 4, f. 9.**

Loc. ? (Census); Circular Head, *W. L. May*.

***A. AUREUM, Jonas (*Trochus*) in Philippi's Abbild., ii., p. 26, 1844, t. 6, f. 2.**

***Carinidea granulata*, Swainson, P.R.S.Tasm., for 1854, p. 40, t. 6, f. 5-6.**

***C. Tasmanica*, Ten.-Woods, P.R.S.Tasm., 1877, p. 142 = *aureum*, jun.**

Common (Census); general, *W. L. May;* King Island, *R. Tate*.

Genus COLLONIA, Gray, 1852.

***C. ROSEA, Ten.-Woods (*Monilea*), P.R.S.Tasm., 1876, p. 154.**

***Collonia ? roseopunctata*, Angas, P.Z.S., 1880, p. 417, t. 50, f. 8.**

Tasmania (type of *C. rosea*).

*C. JOSEPHI, Ten-Woods (*Cyclostrema*), P.R.S.Tasm., 1877, p. 147; Tryon, Man. Conch., x., t. 33, f. 9. **(Text fig. 10.)**

Blackman's Bay (type).

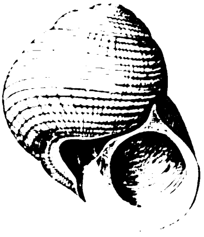


Fig. 10—*C. Josephi.*

Family TROCHIDÆ.

Genus CLANCULUS, Montfort, 1810.

*C. ANUS, Philippi (*Trochus*), Z. f. Mal., 1848; Conch. Cab., p. 266, t. 39, f. 7.

North only (*C. gibbosus*, Census); E. and S. Coasts, *W. L. May*.

*C. ALOYSII, Ten.-Woods, P.R.S.Tasm., 1876, p. 155; Tryon, Man. Conch., xi., p. 50, t. 14, f. 20-23.

S. Coast, *W. L. May;* King Island !.

Var. *Raphaeli*, Ten-Woods., *op. cit*, 1877, p. 144.

George Bay and Long Bay, *Ten.-Woods;* Frederick Henry Bay, *W. L. May*

*C. **Dunkeri**, Koch (*Trochus*), Abbild., i., p. 67, t. 2, f. 5, 1843.
C. rubens, Angas, 1865; Ten.-Woods, 1878.
Bass Straits, rare (Census).

*C. **limbatus**, Quoy & Gaimard (*Trochus*), Voy. Astrolabe, p. 245, t. 63, f. 1-6.
C. variegatus, Angas, 1865; Ten.-Woods, 1878.
King Island, *R. Tate;* very common (Census).

*C. **Maugeri**, Wood (*Trochus*), Index Test. Suppl., p. 220, t. 5, f. 27, 1828; Fischer, Coq. Viv., t. 72, f. 1.
Rare in Tasmania (Census); King Island, *W. F. Petterd* !.

*C. **Philomenæ**, Ten.-Woods, P.R.S.Tasm., 1876, p. 155. (Pl. xxiii., fig. 12).
One example, *Ten.-Woods;* Derwent Estuary, *W. L. May.*

*C. **plebeius**, Philippi, Conch. Cab., 1851, p. 326, t. 46, f. 10.
C. Angeli, *C. Dominicana*, Ten.-Woods, P.R.S.Tasm, 1877, p. 144.
Gibbula multicarinata, Ten.-Woods, *op. cit.*, 1877, p. 142.
General, *W. L. May;* King Island, *R. Tate.*

*C. **undatus**, Lamarck (*Trochus*), Encyc. Méthod., t. 447, f. 3; Fischer, Coq. Viv., t. 56, f. 2.
Common (Census); E. and S. Coasts, *W. L. May.*

*C. **Yatesi**, Crosse, Journ. de Conch., 1863, p. 379, t. 13, f. 1.
Bass Straits and N.E. Coast (Census); also, *A. Simson* !.

Genus **Phasianotrochus**, Fischer, 1885.

Elenchus, H. & A. Adams, 1854, non Swainson, 1840.

P. **eximius**, Perry (*Bulimus*), Conchology, 1811, pl. 30, f. 2.
**P. badius*, Wood (*Trochus*), Index Test., 1818, and Suppl. t. 6, f. 46.
T. lineatus, Lamarck; *T. roseus*, Lamarck; *T. fulmineus*, Kiener.
King Island, *R. Tate;* common (Census).

*P. **bellulus**, Dunker (*Trochus*), Philippi, Abbild., t. 7, f. 6.
Bass Straits (Census); George's Bay, *Aug. Simson* !.

*P. IRISODONTES, Quoy & Gaimard (*Trochus*), Voy. Astrolabe, ii., p. 246, t. 63, f. 7-12.

T. Schrayeri, Philippi; *T. nitidulus*, Philippi.

Common (Census; type of *T. Schrayeri*).

P. APICINUS, Menke (*Monodonta*); Philippi, Conch. Cab., t. 23, f. 5.

Bass Straits, *W. F. Petterd.*

Genus CANTHARIDUS, Montfort, 1810.

C. LEHMANNI, Menke (*Trochus*), 1843; Philippi, Abbild. Conch., ii., t. 7, f. 2, p. 37.

Thalotia Ramburi, Crosse; *Thalotia picta*, Ten.-Woods, 1878.

N. Coast, rare (Census).

C. PULCHERRIMUS, Wood (*Trochus*), Index Test.; Philippi, Abbild., ii., p. 37, t. 7, f. 1.

Thalotia Mariæ, Ten.-Woods, P.R.S.Vict., 1877, p. 58.

N. Coast, rare (Census).

*C. ALLPORTI, Ten.-Woods (*Zizyphinus*), P.R.S.Tasm., 1876, p. 155; Tryon, Man. Conch., p. 351, t. 66, f. 22.

Islands in Bass Straits (Census); Frederick Henry Bay, *W. L. May.*

*C. BAUDINI, Fischer (*Trochus*), 1878; Coq. Viv., p. 356, t. 110, f. 5.

Z. fragum, Ten.-Woods, 1878, non Philippi.

Islands in Bass Straits, rare (Census); King Island (type!); Frederick Henry Bay, *W. L. May.*

Genus THALOTIA, Gray, 1848.

*T. CONICA, Gray (*Monodonta*) in King's Voy., Appx., ii., p. 479, 1827; *Trochus conicus*, Philippi, Conch. Cab., 1849, t. 23, f. 1.

T. dubia, Ten.-Woods, P.R.S.Vict., 1877, p. 59.

Bass Straits and N.E. Coast (Census); Circular Head, *W. L. May.*

The type of *T. dubia* from Clark Island in Nat. Mus. Melbourne is a deformed *T. conica* (*teste* J. H. Gatliff).

Genus CALLIOSTOMA, Swainson, 1840.

Zizyphinus, Gray, 1840.

*C. **MEYERI**, Philippi (*Trochus*), Zeit. f. Mal., 1848, p. 101; Conch. Cab., t. 41, f. 4, 1849.

Z. armillatus, Kiener, Reeve, &c., non Wood.

Z. euglyptus, Adams, P.Z.S., 1854.

Type of *Z. euglyptus*; rather common (Census).

*C. **LEGRANDI**, Ten.-Woods, P.R.S.Tasm., 1876, p. 154; Tryon, Man. Conch., xi., t. 66, f. 23.

Chappell Island, Bass Straits (type); Frederick Henry Bay, *W. L. May*.

*C. **INCERTUM**, Reeve (*Zizyphinus*), Conch. Icon., f. 28.

Tasmania (type); Frederick Henry Bay, *W. L. May*.

*C. **NOBILIS**, Philippi (*Trochus*), Conch. Cab., t. 38, f. 11, 1849.

King Island, *W. F. Petterd* !, *J. H. Gatliff*.

Subgenus ASTELE, Swainson, 1855.

Eutrochus, A. Adams, 1863.

*A. **SUBCARINATUM**, Swainson, P.R.S.Tasm. for 1854, p. 36, t. 6, f. 1-2, 1855.

Eutrochus perspectivus, A. Adams, P.Z.S., 1863, p. 506 = *E. Adamsi*, Pilsbry, Man. Conch., xi., p. 402.

Types of all are Tasmanian; E. Coast (Census); Marion Bay, not uncommon, *W. L. May*.

Genus MINOS, Hutton, 1884.

The author founded this genus on the Tasmanian shell *Fossarina Petterdi;* he placed it in the Family *Stomatiidæ*, but the "horny multispiral operculum, the dentition resembling *Cantharidus*," and the porcellanous, somewhat iridescent, interior induce us to place it in the vicinity of *Gibbula*.

*M. **PETTERDI**, Crosse (*Fossarina*), Journ. de Conch., 1870, p. 303; 1871, t. 12, f. 1.

Minos Petterdi, Hutton, P.L.S.N.S.W., 1884, p. 369.

Fossarina Simsoni, Ten.-Woods, P.R.S.Tasm., 1876, p. 149 (a large form up to 8 mm. diam.).

Hobart (type of *M. Petterdi*); Long Bay, Bruni Island (*F. Simsoni*); E. and S. Coasts, very local, *W. L. May*.

Genus GIBBULA, Risso, 1826.

*G. LEGRANDI, Petterd (*Fossarina*), Journ. Conch., 1879, p. 104. (Pl. xxiv., figs. 21, 22).

Circular Head and King Island, *W. F. Petterd*!; Frederick Henry Bay.

*G. PICTURATA, Adams & Angas, P.Z.S., 1864, p. 36.

Trochus picturatus, Fischer, Coq. Viv., t. 90, f. 2.

Gibbula sulcosa, Ten.-Woods, 1878, non Adams.

Rare (Census; Hobart Mus. !).

*G. COXI, Angas, P.Z.S., 1867, p. 115, t. 13, f. 26.

Rare (Census); Derwent Estuary, *W. L. May*.

*G. TIBERIANA, Crosse (*Trochus*), Journ. de Conch., 1863, p. 381, t. 13, f. 2.

Cantharidus decoratus, Adams & Angas, P.Z.S., 1864, p. 37.

**Gibbula aurea*, Ten.-Woods, P.R.S.Tasm., 1876, p. 155.

**Thalotia tessellata*, Ten.-Woods, P.R.S.Vict., 1877, p. 58.

Trochus (Gibbula) smaltata, Fischer, Journ. de Conch., 1879, p. 22.

King Island ! (type of *G. aurea*); S. and E. Coasts, *W. L. May*.

*G. TASMANICA, Petterd, Journ. Conch., ii., 1879; Tryon, Man. Conch., xi., p. 236, t. 40, f. 20.

Brown River (type !); Frederick Henry Bay, *W. L. May*.

*G. DOLOROSA, Ten.-Woods, P.R.S.Tasm., 1877, p. 143. (Pl. xxiv., fig. 31.)

Bass Straits (type).

Genus MONILEA, Swainson, 1840.

*M. PREISSIANA, Philippi (*Trochus*), Conch. Cab., 1848, t. 28, f. 3.

Gibbula porcellana, A. Adams, P.Z.S., 1854, p. 40.

Gibbula Weldii, Ten.-Woods, P.R.S.Tasm., 1877, p. 143.

Bass Straits (type of *G. Weldii* !).

*M. VITILIGENEA, Menke (*Trochus*); Philippi, Conch. Cab., 1848,

Margarita Tasmanica, Ten.-Woods, P.R.S.Tasm., 1877, p. 143.
Minolia Tasmanica, Tryon, Man. Conch., xi., p.263, t.61, f.38-40.
Bass Straits and Long Bay, *Ten.-Woods;* N. and S. Coasts, *W. L. May.*

Genus MINOLIA, A. Adams, 1860.

*M. PRODICTA, Fischer, Mon. Trochidæ, p. 395, t. 118, f. 1.
Derwent River Estuary, *W. L. May.*

Genus MONODONTA, Lamarck, 1799.

Subgenus TROCHOCOCHLEA, H. & A. Adams, apud Klein, 1753.

*T. CONSTRICTA, Lamarck (*Monodonta*), 1822.
Trochus constrictus, Quoy & Gaimard, Voy. Astrolabe, t. 66, f. 27.
Tasmania (type); common (Census).
Var. *taeniata*, Quoy & Gaimard, t. 63, f. 15-17.
Trochus zebra, Philippi, Conch. Cab., t. 26, f. 24.
T. multicarinatus, Chemnitz; *T. porcata*, Adams.
Common (Census).

*T. AUSTRALIS, Chemnitz (*Monodonta*); Lamarck.
T. concameratus, Wood, Index Test. Suppl., t. 6, f. 35.
T. striolatus, Quoy & Gaimard, Voy. Astrolabe, t. 63, f. 18-22.
King Island, *R. Tate;* —— (Census).

*T. MELANOLOMA, Menke (*Monodonta*), 1843; Philippi, Abbild., ii., t. 5, f. 2, p. 188, 1845.
N. Coast, *W. F. Petterd* !.

Subgenus DILOMA, Philippi, 1845.

*D. ODONTIS, Gray (*Trochus*), Wood, Index Test. Suppl., t. 6, f. 37; Philippi, Conch. Cab., 1849, t. 24, f. 17.
Gibbula tesserula, Ten.-Woods, P.R.S.Vict., xvii., 1881, p. 81, t. 1, f. 5 (very young *D. odontis*).
Common (Census); King Island, *R. Tate;* S. Coast, common, *W. L. May.*

*D. ADELAIDÆ, Philippi (*Trochus*), Conch. Cab., 1849, t. 24, f. 1. (Pl. xxiv., fig. 31).
D. australis, Ten.-Woods, P.R.S.Tasm., 1877, p. 145.

Gibbula depressa, Ten.-Woods, P.R.S.Tasm., 1876, p. 154; Tryon, Man. Conch., xi., t. 40, f. 36-37 (is the young).

Adventure Bay (*G. depressa*, common); N. Coast (*D. australis*, Ten.-Woods); Frederick Henry Bay, *W. L. May*.

Genus BANKIVIA, Beck, 1848.

*B. FASCIATA, Menke (*Phasianella*).

B. varians, Philippi, Conch. Cab., t. 5, f. 1-5.

Var. *B. major*, A. Adams, P.Z.S., 1851, p. 171.

Very common (Census; type of *B. major*).

Genus EUCHELUS, Philippi, 1847.

*E. BACCATUS, Menke (*Monodonta*), 1843; Philippi, Conch. Cab., t. 27, f. 13.

N. and E. Coasts, not found in the south, *W. L. May;* King Island !.

*E. SCABRIUSCULUS, Angas, P.Z.S., 1867, p. 215.

Trochus scabriusculus, Fischer, Coq. Viv., 1880, t. 14, f. 2.

E. Tasmanicus, Ten.-Woods, P.R.S.Tasm., 1876, p. 152.

Long Bay (type of *E. Tasmanicus*); Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May;* King Island !.

Family STOMATIIDÆ.

Genus STOMATELLA, Lamarck, 1809.

S. IMBRICATA, Lamarck; Deshayes, Encyc. Méthod., t. 450, f. 2; Sowerby, Thes. Conch., ii., p. 833, t. 174, f. 1.

Bass Straits, rare (Census); King Island !.

Genus GENA, Gray, 1840.

*G. NIGRA, Quoy & Gaimard (*Stomatella*), Voy. Astrolabe, t. 66 bis, f. 13-16.

G. strigosa, Angas, 1867; Ten.-Woods, 1878.

Bass Straits, rare (Census); Frederick Henry Bay, very rare, *W. L. May*.

Family HALIOTIDÆ.

Genus HALIOTIS, Linné, 1758.

*H. ALBICANS, Quoy & Gaimard, Voy. Astrolabe, t. 68, f. 1-2.
H. glabra [Swainson], Ten.-Woods, non Chemnitz.
N. Coast (Census).

*H. NAEVOSA, Martyn, Univ. Conch., t. 11, f. 3; Philippi, Abbild., i., t. 2-3; Reeve, Conch. Icon., f. 27.
Common (Census); E. and S. Coasts, *W. L. May;* King Island !.

*H. EMMÆ, Gray in Reeve, Conch. Icon., f. 29, 1846.
Somewhat common (Census); Circular Head, *W. L. May.*

Family PLEUROTOMARIIDÆ.

Genus SCHISMOPE, Jeffreys, 1856.

*S. ATKINSONI, Ten.-Woods (*Scissurella*), P.R.S.Tasm., 1877, p. 149.
Schismope Atkinsoni, Ten.-Woods, *op. cit.*, 1878.
S. carinata, Watson, Challenger Exped., p. 119, t. 8, f. 6, 1886.
Blackman's Bay (type); Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May.*

*S. BEDDOMEI, Petterd, Journ. Conch, 1884, p. 139. **(Pl. xxiv., fig. 24).**
N. Coast (type !).

*S. PULCHRA, Petterd, *op. cit.*, p. 139; Hedley, P.L.S.N.S.W., xxv., p. 726, f. 25.
N.W. Coast (type !); D'Entrecasteaux Channel, rare, *W. L. May.*

*S. TASMANICA, Petterd, *op. cit.*, 1879, p. 104. **(Pl. xxiv., fig. 23).**
Blackman's Bay (type !).

Family IANTHINIDÆ.

Genus IANTHINA, Lamarck, 1799.

*I. COMMUNIS, Lamarck, An. s. Vert., ix., p. 4; Reeve, Conch. Icon., f. 5, 1858.
E. Coast (Census); also, S. Coast occasionally, *W. L. May.*

*I. EXIGUA, Lamarck, *op. cit.*, p. 5; Reeve, Conch. Icon., f. 21.
E. Coast (Census); rare, *W. L. May.*

Family FISSURELLIDÆ.

Genus Fissurella, Bruguière, 1789.

Subgenus Lucapinella, Pilsbry, 1890.

***F. nigrita**, Sowerby, P.Z.S., 1834, p. 127; Thes. Conch., iii., t. 8, f. 196.

N. Coast and Blackman's Bay (Census); E. Coast, rare, *W. L. May;* King Island !.

F. crucis, Beddome, P.R.S.Tasm., 1883, p. 169. (Text fig. 11.)

Tamar River (type of *crucis*).

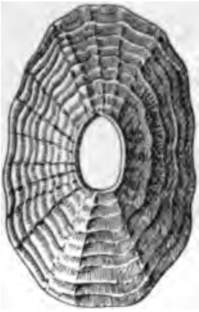


Fig. 11 – *F. crucis.*

Subgenus Megatebennus, Pilsbry, 1890.

***F. scutella**, Sowerby, Conch. Illus., f. 34; *F. trapezina*, Sowerby, P.Z.S., 1834; *F. Tasmaniensis*, Bonnet, Rev. et Mag. de Zool., 1864, t. 6, f. 5.

Type of *F. Tasmaniensis;* Tasmania (Census); E. and S. Coasts, common, *W. L. May.*

Subgenus Macrochisma, Swainson, 1840.

*F. Tasmaniæ, Sowerby, Thes. Conch., p. 206, f. 223.

M. Tasmanica, Ten.-Woods, P.R.S.Tasm., 1876, p. 157.

M. Weldii, et var. *roseoradiata*, Ten.-Woods, *op. cit.*, 1877, p. 156; Tryon, Man. Conch., xii., t. 59, f. 33-35.

Common (Census); King Island, *R. Tate;* Frederick Henry Bay, rare, *W. L. May.*

Genus Fissurellidea, D'Orbigny, 1839.

*F. concatenata, Crosse & Fischer (*Fissurella*), Journ. de Conch., 1864, p. 348; 1865, p. 41, t. 3, f. 1-3.

Long Bay; N.W. Coast, George Town (Census); King Island, *R. Tate;* Frederick Henry Bay, rare, *W. L. May.*

Genus FISSURIDEA, Swainson, 1840.

Capiluna, Gray, 1840; *Glyphis*, Carpenter, 1856.

*F. LINEATA, Sowerby (*Fissurella*), Conch. Illust.; Thes. Conch., iii., t. 241, f. 134-135.

F. australis [Krauss], Ten.-Woods, 1878.

Rare, E. Coast (Census); Hobart Mus. !.

Genus EMARGINULA, Lamarck, 1801.

*E. CANDIDA, A. Adams, P.Z.S., 1851; Reeve, Conch. Icon., f. 45.

(Coll. Rev. T. Hull !); King Island, *R. Tate;* N. and S. Coasts, uncommon, *W. L. May.*

*E. DILECTA, A. Adams, P.Z.S., 1851, p. 85; Reeve, Conch. Icon., f. 23.

W. L. May; King Island !.

Genus SUBEMARGINULA, Blainville, 1825.

*S. AUSTRALIS, Q. & G. (*Emarginula*), Voy. Astrol., t. 68, f. 11-12.

E. Tasmaniæ, Sowerby, Thes. Conch., f. 72.

E. emarginata, Ten.-Woods, 1878, non Blainville.

Type of *E. Tasmaniæ;* common (Census).

*S. RUGOSA, Q. & G. (*Emarginula*), *op. cit.*, t. 68, f. 17-18.

King Island, *R. Tate;* N., E., and S. Coasts, common, *W. L. May;* not common (Census).

Subgenus TUGALIA, Gray, 1844.

*T. PARMOPHOROIDEA, Q. & G. (*Emarginula*), *op. cit.*, t. 68, f. 15-16.

T. australis, Ten.-Woods, P.R.S.Tasm., 1878 = *T. ossea*, Sowerby, non Gould.

T. Tasmanica, Ten.-Woods, P.R.S.Tasm., 1877, p. 156 (is a senile example).

Somewhat common (Census).

Genus SCUTUM, Montfort, 1810.

Parmophorus, Blainville, 1817.

*S. ANATINUM, Donovan.
P. elongatus, Blainv.; *P. australis*, Lamarck, 1822; *P. convexus*, Q. & G., *op. cit.*, t. 69, f. 1-17.
Somewhat common (Census); Frederick Henry and Storm Bays, *W. L. May*.

Genus PUNCTURELLA, Lowe, 1827.

Cemoria auct.

*P. HARRISSONI, Beddome, P.R.S.Tasm., 1883, p. 168.
P. Henniana, Brazier, P.L.S.N.S.W., 1894, p. 177, t. 14, f. 14.
Brown's River and Bruni Island, *Beddome;* Frederick Henry Bay and D'Entrecasteaux Channel, *W. L. May;* also, Sydney, *J. Brazier*, and Victoria, *R. Tate*.

Genus ZIDORA, A. Adams, 1860.

Legrandia, Beddome, 1883.

***Z. TASMANICA, Beddome, P.R.S.Tasm., 1883 p. 169. (Pl. xxiv., figs. 25, 26).**
Zidora Legrandi, Tate, T.R.S.S.Aust., xviii., p. 118, 1894.
Kelso Bay, Tamar River (type).

Z. LODDERÆ, Tate & May, T.R.S.S.Aust., xxiv., p. 101, 1900.
Z. Tasmanica, Hedley, P.L.S.N.S.W., xxv., 1900, p. 93, 3 wdcts. (Coll. Miss Lodder).

Family PATELLIDÆ.

Genus PATELLA, Linné, 1758.

*P. STELLÆFORMIS, Reeve, Conch. Icon., f. 48.
*Var. *Acmæa alba*, Ten.-Woods, P.R.S.Tasm., 1877, p. 155; Tryon, Man. Conch., xii., p. 54, t. 42, f. 76-78.
**P. Chapmani*, Ten.-Woods, *op. cit.*, 1876, p. 157.
N. Coast (type of *A. alba*).

*P. ACULEATA, Reeve, Conch. Icon., t. 32, f. 90.
King Island; Derwent Estuary, *R. Tate;* Recherche Bay

*P. USTULATA, Reeve, Conch. Icon., f. 88.
P. Tasmanica, Ten.-Woods, P R.S.Tasm., 1876, p. 157.
Common (Census); Recherche Bay (type of *P. Tasmanica*); Frederick Henry Bay, *W. L. May*.

Genus HELCIONISCUS, Dall, 1871.

*H. TRAMOSERICUS, Martyn (*Patella*), Univ. Conch., i., t. 16; Reeve, Mon. *Patella*, f. 27.
P. limbata, Philippi, Abbild. Conch., iii., 1849, t. 3, f. 2.
P. Diemenensis, Philippi, Z.f.Mal., 1848, p. 162.
King Island, *R. Tate;* common (Census); Hobart (type of *P. Diemenensis*).

Genus NACELLA, Schumacher, 1817.

*N. TASMANICA, Tate & May, T.R.S.S.Aust., xxiv., p. 102, 1900. (Pl. xxvii., figs. 89-90).
N. parva, var. *Tasmanica*, Pilsbry, "Nautilus," 1895, p. 128.
Frederick Henry Bay, *W. L. May*.

Family ACMÆIDÆ.

Genus ACMÆA, Eschscholtz, 1828.

Patelloidea, Quoy & Gaimard, 1833; *Lottia*, Gray, 1833.

*A. SACCARHINA, Linné; Reeve, Conch. Icon., f. 72.
P. stellaris, Q. & G., Voy. Astrolabe, iii., t. 71, f. 1-4.
King Island, *R. Tate;* E. Coast, *W. L. May*.

*A. COSTATA, Sowerby (*Lottia ?*), Moll. Beechey's Voy., t. 39, f. 2, 1829.
Patella alticostata, Angas, P.Z.S., 1865, p. 56, t. 2, f. 11.
P. costata [Sow.] Angas, P.Z.S., 1867, p. 221.
Acmæa costata, Ten.-Woods, P.R.S.Tasm., 1877, p. 50.
Common (Census); on S. and E. Coasts, *W. L. May*.

*A. CRUCIATA, Linné sp.; Tryon, Man. Conch., xiii., p. 169, t. 73, f. 95.
Patelloidea flammea, Q. & G., Voy. Astrolabe, t. 71, f. 15-24.
Acmæa crucis, Ten.-Woods, P.R.S.Tasm., 1877, p. 52; 1878, p. 53; Tryon, Man. Conch., xiii., p. 58, t. 37, f. 17-18.
Loc. ? (Census); King Island, *R. Tate*.

*A. CONOIDEA, Q. & G. (*Patelloidea*), Voy. Astrolabe, t. 71, f. 5-7, 1833.
Patella calamus, Crosse & Fischer, Journ. de Conch., 1864, p. 348; 1865, t. 3, f. 7-8, p. 42.
Common, S. and E. Coasts (Census); King Island !.

*A. SEPTIFORMIS, Q. & G. (*Patelloidea*), *op. cit.*, t. 71, f. 43-44.
A. Petterdi, Ten.-Woods, P.R.S.Tasm., 1877, p. 155, is a senile form.
Somewhat common (Census); King Island, *R. Tate;* Frederick Henry Bay, *W. L. May*.

*A. CANTHARUS, Reeve, Mon. *Patella*, t. 4, f. 131.
Loc. ? (Census); Frederick Henry Bay, *W. L. May*.

*A. GEALEI, Angas (*Patella*), P.Z.S., 1865, p. 87.
Patella Jacksoniensis, Reeve, Conch. Icon., f. 27, non Lesson, 1830.
Frederick Henry Bay, *W. L. May*.

*A. MARMORATA, Ten.-Woods, P.R.S.Tasm., 1876, p. 24; Tryon, Man. Conch., xiii, p. 52, t. 42, f. 66-68.

Subclass POLYPLACOPHORA.

Family LEPIDOPLEURIDÆ.

Genus LEPIDOPLEURUS, Risso, 1826.

L. INQUINATUS, Reeve, Conch. Icon., *Chiton*, f. 154, 1847.
L. liratus, Ad. & Ang., 1864; Ten.-Woods, Census, 1878.
Type of *L. inquinatus* (Brit. Mus.).

*L. MATTHEWSI, Pilsbry, "Nautilus," 1894, p. 120.
Near Devonport, *W. L. May*.

Family ISCHNOCHITONIDÆ.

Genus CALLOCHITON, Gray, 1847.

*C. INORNATUS, Ten.-Woods (*Chiton*), P.R.S.Vict., xvii., 1881, p. 82, t. —, f. 8-9.
Stenochiton lobatus, Pilsbry, Man. Conch., xiv., p. 53, t. 8, f. 83-85.

Genus ISCHNOCHITON, Gray, 1847.

I. CRISPUS, Reeve, Conch. Icon., *Chiton*, f. 120.
I. Haddoni, Pilsbry, 1894; *Chiton longicymba*, Sowb.
Common, S. and E. Coasts, very variable in colour, *W. L. May.*

*I. FRUTICOSUS, Gould, "Otia," p. 4.
Chiton divergens, Reeve, Conch. Icon., 1847; *C. proteus*, Angas, non Reeve.
Census.

I. CARINULATUS, Reeve, Conch. Icon., *Chiton.*
Type (Brit. Mus.).

I. CONTRACTUS, Reeve, Conch. Icon., *Chiton*, f. 78.
Type (Brit. Mus.); Census.

*I. TATEANUS, Bednall, Mal. Soc., ii., p. 147, t. 12, f. 3, 1897.
Frederick Henry Bay, *W. L. May.*

*I. SMARAGDINUS, Angas (*Lophyrus*), P.Z.S., 1867, p. 115, t. 13, f. 28.
N. Coast only, *W. L. May;* Table Cape, *R. Tate.*

Genus ICHNORADSIA, Shuttleworth, 1853.

*I. NOVÆ-HOLLANDIÆ, Reeve, Conch. Icon., *Chiton* sp., 142.
Frederick Henry Bay, not common, *W. L. May.*

Subgenus HAPLOPAX, Pilsbry, 1894.

*H. MAYII, Pilsbry, "Nautilus," viii., p. 128, 1895.
Pirate's Bay (type !).

Genus CALLISTOCHITON, Carpenter, 1879.

*C. ANTIQUUS, Reeve, Conch. Icon., *Chiton*, f. 169.
Loc. ? (Coll. Miss Lodder !).

Family MOPALIIDÆ.

Genus PLAXIPHORA, Gray, 1847.

*P. PETHOLATA, Sowerby, Conch. Illus., f. 65-66.
E. and S. Coasts, not common, *W. L. May.*

*P **GLAUCA**, Quoy & Gaimard (*Chiton*), Voy. Astrolabe, iii., 1835, t. 74, f. 7-11, p. 376.
D'Entrecasteaux Channel (type); E. and S. Coasts, very plentiful and large, *W. L. May.*

Family ACANTHOCHITIDÆ.

Genus ACANTHOCHITES, Risso, 1826.

A. **ASBESTOIDES**, Smith, Zool. Alert, p. 83, t. 6, f. G.
Flinders Island (type Brit. Mus.); S. Coast, common, *W. L. May.*

*A. **BEDNALLI**, Pilsbry, Acad. Nat. Sc. Philad., 1894, p. 81, t. 2, f. 7-11.
Frederick Henry Bay, rare, *W. L. May.*

*A. **GRANOSTRIATUS**, Pilsbry, *op. cit.*, p. 81, t. 2, f. 1-6.
Frederick Henry Bay, rare, *W. L. May.*

*A. **COSTATUS**, Ad. & Ang., P.Z.S., 1864; Smith, Zool. Alert, p. 83, t. 6, f. F.
Loc. ? (Coll. W. F. Petterd !).

*A. **SPECIOSUS**, H. Adams (*Cryptoplax*), P.Z.S., 1861; Pilsbry, Man. Conch., xv., t. 1, f. 23-26.
Types in Brit. Mus.; Tasmania (Cuming Coll.); Flinders Island, *Milligan*; rare, D'Entrecasteaux Channel, *W. L. May.*

Family CRYPTOPLACIDÆ.

Genus CRYPTOPLAX, Blainville, 1817.

*C. **STRIATUS**, Lamarck (*Chitonellus*).
Var. *Gunni*, Reeve, Conch. Icon., *Chiton*, sp. 5.
Type of *C. Gunni*; E. Coast, common, *W. L. May.*

Family CHITONIDÆ.

Genus CHITON, Linné, 1758.

*C. **JUGOSUS**, Gould, "Otia," p. 3, 1846.
C. concentricus, Reeve, Conch. Icon., f. 95.
Frederick Henry Bay and Derwent Estuary, rare, *W. L. May.*

*C. PELLIS-SERPENTIS, Q. & G., Voy. Astrolabe, iii., 1835, t. 74, f. 17-22, p. 381.

Loc. ? (Census); Frederick Henry Bay, common, *W. L. May*.

Genus LORICELLA, Pilsbry, 1894.

*L. ANGASI, H. Adams (*Lorica*), P.Z.S., 1864, p. 193; Pilsbry, Man. Conch., xiv., t. 51, f. 9-13.

The Leven, *Miss Lodder* (Hobart Mus. !).

Genus LIOLOPHURA, Pilsbry, 1893.

L. GAIMARDI, Blainv. (*Chiton*), Dict. Sc. Nat., Vol. 36, p. 546, 1825.

L. Gaimardi, Pilsbry, Man. Conch., xiv., p. 240, 1893.

Census (*C. piceus*); Kangaroo Point, *W. F. Petterd*.

Subclass OPISTHOBRANCHIATA.

Family ACTÆONIDÆ.

Genus ACTÆON, Montfort, 1810.

[= *Tornatella*, Lamarck, 1812].

A. MINUTUS, Petterd (*Tornatella*), Journ. Conch., 1879, p. 105. Furneaux Group (type).

Genus ADELACTEON, Cossmann, 1895.

[= *Myonia*, Adams, 1860, non Dana, 1847].

*A. CASTA, A. Adams (*Monoptygma*), P.Z.S., 1851; *M. concinna*, A. Adams, Thes. Conch., ii., p. 818, pl. clxxii., f. 22.

Rissoa punctato-striata, Ten.-Woods, P.R.S.Tasm., 1879, p. 35.

Table Cape (*Ten.-Woods*); D'Entrecasteaux Channel, *W. L. May*.

Family TORNATINIDÆ.

Genus TORNATINA, A. Adams, 1850.

*T. FUSIFORMIS, A. Adams in Sowerby's Thes. Conch., iii., t. 121, f. 37.

T. Mariæ, Ten.-Woods, P.R.S.Tasm., 1877, p. 155.

N.W. Coast, *Ten-Woods* !; Frederick Henry Bay, *W. L. May*.

*T. BRENCHLEYI, Angas, P.Z.S., 1877, p. 40, t. 5, f. 20.

Loc. ? (Coll. W. F. Petterd !).

Genus VOLVULELLA, Newton, 1891.

[= *Volvula*, Adams, 1850, non Oken, 1815].

*V. ROSTRATA, A. Adams in Sowerby's Thes. Conch., t. 125, f. 154.
Loc. ? (Coll. W. F. Petterd !); Long Bay, *Atkinson* !; D'Entrecasteaux Channel, *W. L. May*.

Genus BULLINELLA, Newton, 1891.

[= *Cylichna*, Lovén, 1846, non Burmeister, 1844].

*B. ARACHIS, Q. & G. (*Bulla*), Voy. Astrolabe, ii., t. 26, f. 28-30.
Long Bay, rare (Census); Frederick Henry Bay, *W. L. May*.

*B. PYGMÆA, A. Adams, Thes. Conch., t. 125, f. 150.
Common, Frederick Henry Bay, *W. L. May*.

*B. ATKINSONI, Ten.-Woods, P.R.S.Tasm., 1876, p. 156.
Long Bay !, not common, *Ten.-Woods*; D'Entrecasteaux Channel, *W. L. May*.

Genus RETUSA, 1827.

[= *Utriculus*, Brown, 1827, non Schum., 1817].

*R. EUMICRA, Crosse (*Bulla*), Journ. de Conch., 1865, p. 40, t. 2, f. 7.
N. Coast, *W. F. Petterd* !.

Family BULLIDÆ.

Genus BULLA, Linné, 1759.

*B. AUSTRALIS, Gray, 1825; Q. & G., Voy. Astrolabe, ii., t. 26, f. 38-39.
Loc. ? (Census); Circular Head, *W. L. May*.

Genus HAMINEA, Leach, 1847.

*H. BREVIS, Q. & G. (*Bulla*), Voy. Astrolabe, ii., t. 26, f. 36-37.
Loc. ? (Coll. W. F. Petterd); (Coll. A. Simson !).

*H. TENERA, A. Adams, Thes. Conch., t. 124, f. 103.
Rare, Islands in Bass Straits (Census); Frederick Henry Bay, *W. L. May*.

Genus ROXANIA, Leach, 1847.

*R. **exigua**, A. Adams (*Atys*), P.Z.S., 1878, p. 869.
Derwent Estuary, *W. L. May*.

Family AKERIDÆ.

Genus AKERA, Müller, 1776.

*A. **Tasmanica**, Beddome, P.R.S.Tasm., 1883, p. 169.
Hydatina tasmanica, Hedley, P.L.S.N.S.W., xxv., p. 725, f. 22, 1901.
Loc. ? (Coll. W. F. Petterd !); Brown River (type).

Genus AMPHISPHYRA, Loven, 1846.

[= *Diaphana*, Brown, 1833, non Hubn., 1816].

A. **Brazieri**, Angas (*Diaphana*), P.Z.S., 1877, p. 179, t. 26, f. 20.
Loc. ? (Coll. C. E. Beddome).

Family RINGICULIDÆ.

Genus RINGICULA, Deshayes, 1838.

R. **australis**, Hinds, P.Z.S., 1844, p. 97; Crosse & Fischer, Journ. de Conch., 1865, p. 44, t. 2, f. 5 = *R. Angasi*, Brazier.
Loc. ? (Census).

Family APLUSTRIDÆ.

Genus BULLINULA, Beck, 1840.

[= *Bullina*, Adams, non Férussac, 1821].

*B **lineata**, Gray (*Bulla*), 1825; Wood, Index Test. Suppl. t. 30.
Bullina lineata, Sowerby, Thes. Conch., t. 120, f. 2; Reeve, Conch. Icon., f. 2.
Pirate's Bay, E. Coast, *W. L. May*.

Family APLYSIIDÆ.

Genus APLYSIA, Linné, 1767.

*A. **concava**, Sowerby, Gen. Shells; Reeve, Mon.; Conch. Icon., sp. 24.
Maria Island, *W. F. Petterd* !; Bruni Island (Census).

*A. TASMANICA, Ten.-Woods, P.R.S.Tasm., 1876, p. 156.
Loc. ? (type); Frederick Henry Bay, common, *W. L. May.*

Family PHILINIDÆ.

Genus PHILINE, Ascanius, 1772.

*P. APERTA, Linné.
P. Angasi, Crosse (*Bulla*), Journ. de Conch., 1865, p. 38, t. 2, f. 8.
Rare (Census); Circular Head, common, *W. L. May.*

Subclass NUDIBRANCHIATA.

Family ELYSIIDÆ.

Genus ALLPORTIA, Ten.-Woods, 1877.

A. EXPANSA, Ten.-Woods, P.R.S.Tasm., 1877, p. 28.
Southport (type).

Subclass PULMONIFERA.

Family AMPHIBOLIDÆ.

Genus AMPHIBOLA, Schumacher, 1817.

*A. FRAGILIS, Lamarck (*Ampullaria*), An. s. Vert., vi., p. 179.
Ampullacera fragilis, Q. & G., Voy. Astrolabe, ii., t. 15, f. 10-12, 1832.
Cotype of *A. fragilis*; common (Census).

*A. QUOYANA, Potiez & Michaud (*Amphibola*), Galerie Moll., t. 15, f. 10-12, 1832.
Ampullacera fragilis (var.), Q. & G., *op. cit.*, f. 13-16.
Loc. ? (type), (Census); Ralph's Bay, common, *W. L. May.*

Family SIPHONARIIDÆ.

Genus SIPHONARIA, Sowerby, 1824.

*S. DIEMENENSIS, Q. & G., Voy. Astrolabe, ii., p. 327, t. 25, f. 1-22, 1833.
Type; very common (Census); King Island !.
*Var. *S. denticulata*, Q. & G., *op. cit.*, f. 19-20, p. 340.
Not common (Census); King Island !.

*S. FUNICULATA, Reeve, Conch. Icon., t. 2, f. 6.
S. zonata, Ten.-Woods, P.R.S.Tasm., 1878, p. 99.
Type of *S. funiculata;* S. Coast (type of *S. zonata*); Frederick Henry Bay and E. Coast, common, *W. L. May.*

*S. TRISTENSIS, Sowerby, Gen. Shells, i., t. 143, f. 3; Reeve, Conch. Icon., f. 23; *S. redimiculum*, Reeve.
Table Cape, not uncommon, *R. Tate;* Frederick Henry Bay, common, *W. L. May;* also Port Phillip, *J. B. Wilson* !.

*S. ALBIDA, Angas, P.Z.S., 1878, p. 314, t. 18, f. 14-15.
Frederick Henry Bay, *W. L. May.*

Family AURICULIDÆ.

Genus ALEXIA, Leach, 1847.

*A. MERIDIONALIS, Brazier, P.L.S.N.S.W., ii., p. 26, 1877. (Pl. xxiii., fig. 7).
A. Harrissoni, Beddome, P.R.S.Tasm., 1883, p. 169.
Ralph's Bay, common, *W. L. May;* Derwent R., *C. Beddome.*

Genus MARINULA, King, 1832.

*M. PATULA, Lowe (*Melampus*), Zool. Journ., v., p. 289, 1835.
Auricula pellucida, Cooper, Microscopic Journ., 1841, p. 16.
Marinula xanthostoma, Adams, P.Z.S., 1854, p. 35.
Cremnobates solida, Swains., P.R.S.Tasm., 1856, p. 44, t. 7, f. 2.
Marinula pellucida [Cooper], Ten.-Woods, 1878.
Flinders Island (type of *C. solida*); common (Census); King Island !; Tasmania (type of *A. pellucida*).

Genus CASSIDULA, Férussac, 1821.

*C. ZONATA, H. & A. Adams, P.Z.S., 1854, p. 32.
Auricula Dyeriana, Ten.-Woods, P.R.S.Tasm., 1876, p. 158.
Kelso (type of *A. Dyeriana*).

Genus OPHICARDELUS, Beck, 1837.

O. AUSTRALIS, Q. & G. (*Auricula*), Voy. Astrolabe, ii., t. 13, f. 34-38, 1832.
O. cornea, Swainson, P.R.S.Tasm., 1856, p. 43.
Cotype, Hobart (Q. & G.); Ralph's Bay, *W. L. May.*

*O. parvus, Swainson (*Cremnobates*), P.R.S.Tasm., 1856, p. 44, t. 7, f. 3.

Oyster Cove, near Hobart (type); near Pirate's Bay, *W. L. May.*

*O. minor, Mousson (*Melampus*), Journ. de Conch., 1859, p. 65, t. 5, f. 3.

Tamar Heads, *W. F. Petterd* !.

Class SCAPHOPODA.

Family DENTALIIDÆ.

Genus Dentalium, Linné, 1758.

D. Tasmaniense, Ten.-Woods, P.R.S.Tasm., 1877, p. 140.

N.W. Coast (type).

D. Weldianum, Ten.-Woods, *op. cit.*, p. 140. **(Pl. xxv., fig. 51).**

N. Coast (type).

Family SIPHODENTALIIDÆ.

Genus Cadulus, Philippi, 1844.

*C. acuminatus, Tate, T.R.S.S.Aust., ix., 1887, p. 194, t. 20, f. 10; xxiii., p. 266, t. 8, f. 11, 1899.

Very plentiful near Circular Head, *W. L. May;* (Coll. W. F. Petterd !).

*C. spretus, Tate & May, T.R.S.S.Aust., xxiv., 1900, p. 102. **(Pl. xxv., fig. 52).**

Port Esperance in 24 fathoms, *W. L. May.*

Class LAMELLIBRANCHIATA.

Family GASTROCHAENIDÆ.

Genus Humphreyia, Gray, 1858.

*H. Strangei, Adams (*Aspergillum*), P.Z.S., 1852, p. 91, t. 15, f. 5; Reeve, Mon. *Aspergillum*, f. 4, 1860.

Rare, N., also Islands in Bass Straits (Census).

Genus Gastrochaena, Spengler, 1783.

*G. Tasmanica, Ten.-Woods, P.R.S.Tasm., 1877, p. 59; Tate, T.R.S.S.Aust., ix., 1887, p. 81, t. 5, f. 10*a*-*b*.

Family TEREDIDÆ.

Genus NAUSITORA, Wright, 1865.

[=*Calobates*, Gould, 1862, *nom. præocc.*].

***N. SAULII**, Wright, Trans. Linn. Soc., xxv., t. 65, p. 567, 1865.
Teredo fragilis, Tate, T.R.S.S.Aust., xii., 1889, p. 60, t. 11, f. 13*a-c*.
Frederick Henry Bay, common, *W. L. May*.

Family PHOLADIDÆ.

Genus BARNEA, Risso, 1826.

***B. AUSTRALASIÆ**, Gray, Ann. Mag. Nat. Hist., p. 381.
Sowerby (*Pholas*), Thes. Conch., t. 106, f. 73.
Rather uncommon (Census); Frederick Henry Bay, *W. L. May*.

***B. OBTURAMENTUM**, Hedley, Records Aust. Mus., ii., p. 55, t. 14, 1893; *B. similis*, auct., non Gray.
N. Coast, *W. F. Petterd*!; Frederick Henry Bay and Derwent Estuary, *W. L. May*.

Family CORBULIDÆ.

Genus CORBULA, Bruguière, 1792.

***C. SCAPHOIDES**, Hinds, P.Z.S., 1843, p. 56; Reeve, Conch. Icon., f. 24.
King Island and Circular Head, *W. F. Petterd*!.

Genus CUSPIDARIA, Nardo, 1840.

[=*Neæra*, Gray, 1834, non R. Devoid, 1830].

***C. TASMANICA**, Ten.-Woods, P.R.S.Tasm., 1876, p. 27; Tate, T.R.S.S.Aust., xxi., 1897, p. 44.
Long Bay (type!); D'Entrecasteaux Channel, *W. L. May*.

Family SAXICAVIDÆ.

Genus SAXICAVA, Bellevue, 1802.

***S. ARCTICA**, Linné (*Mya*), 1767.
Corbula australis, Lamarck; *Saxicava veneriformis*, Lamarck, An. s. Vert., v., p. 502, 1818.
Long Bay! (Census); Frederick Henry Bay, *W. L. May*.

Genus PANOPÆA, Menard de la Groye, 1807.

*P. AUSTRALIS, Sowerby, Genera Shells, t. 40, f. 2.
E. Coast and Frederick Henry Bay, *W. L. May;* rare (Census).

Family SOLENIDÆ.

Genus SOLEN, Linné, 1758.

*S. VAGINOIDES, Lamarck, An. s. Vert., v., p. 4; Delessert, Recueil, t. 2, f. 3, 1841.
Canal D'Entrecasteaux (type); common (Census).

Family ANATINIIDÆ.

Genus MYODORA, Gray, 1840.

*M. ALBIDA, Ten.-Woods, P.R.S.Tasm., 1876, p. 160.
M. corrugata, Verco, T.R.S.S.Aust., xx., 1896, t. 8, f. 1.
Loc. ? (Coll. W. F. Petterd !); Long Bay (type).

*M. BREVIS, Stutchbury, 1829; Reeve, Conch. Icon., f. 7.
Little Norfolk Bay, common; Frederick Henry Bay, *W. L. May;* rare, S. Coast (Census).

*M. OVATA, Reeve, Conch. Icon., f. 4.
Loc. ? (Census); Frederick Henry Bay, *W. L. May.*

M. PANDORÆFORMIS, Stutchbury; Reeve, Conch. Icon., f. 10.
S. and E. Coasts, rare (Census).

*M. TASMANICA, Ten.-Woods, P.R.S.Tasm., 1876, p. 160. **(Pl. xxvii., figs. 104-106).**
Long Bay (type); Cloudy Bay, Bruni Island, *W. L. May.*

Genus THRACIOPSIS, Tate & May, 1900.

[= *Alicia*, Angas, 1867, non Johnston, 1861].

*T. ANGUSTATA, Angas (*Alicia*), P.Z.S., 1867, p. 908, t. 44, f. 1.
Pirate's Bay, E. Coast, common, *W. L. May.*

Genus MYOCHAMA, Stutchbury, 1830.

*M. ANOMIOIDES, Stutchbury, Zool. Journ.; Reeve, Conch. Icon., f. 2-4.
Rare (Census); N. Coast, *W. L. May.*

*M. **Tasmanica**, Ten.-Woods (*Gouldia*), P.R.S.Tasm., 1877, p. 158; *Myochama Woodsi*, Petterd, Journ. Conch., 1884, p. 145.
Long Bay, D'Entrecasteaux Channel (both types !).

Genus Anatina, Lamarck, 1809.

*A. **Angasi**, Crosse & Fischer (*Periploma*), Journ. de Conch., 1864, p. 349; 1865, p. 427, t. 11, f. 1.
Tasmania (cotype); Oyster Bay, Frederick Henry Bay ! (Census); Circular Head, *W. L. May*.

*A. **Tasmanica**, Reeve, Conch. Icon., f. 20.
A. recta, Reeve, *op. cit.*, f. 24.
Type, not common (Census); Ralph's Bay, Frederick Henry Bay, &c., *W. L. May*.

*A. **creccina**, Reeve, Conch. Icon., f. 12.
Kelso, rare (Census); Circular Head, *W. L. May*.

Genus Thracia, Blainville, 1824.

*T. **modesta**, Angas, P.Z.S., 1867, t. 44, f. 3.
Derwent Estuary, *W. L. May*.

Family MACTRIDÆ.

Genus Mactra, Lamarck, 1799.

*M. **Matthewsi**, Tate, T.R.S.S.Aust., xi., 1889, p. 60, t. 11, f. 4.
Loc. ? (Coll. W. F. Petterd !).

*M. **polita**, Chemnitz, 1782, vi., 222, f. 216-7.
Hobart Mus. ! (Miss Lodder).

*M. **pura**, Deshayes, 1853; Reeve, Conch. Icon., f. 53.
N. Coast, uncommon, *W. L. May;* (Census).

*M. **rufescens**, Lamarck, 1818; Reeve, Conch. Icon., f. 9.
Common (Census).

Subgenus Mactrella (Gray), Dall, 1894.

*M. **ovalina**, Lamarck, 1818; Delessert, Recueil, t. 3, f. 7, 1841; *M. depressa*, Reeve, Mon. *Mactra*, f. 76.
Frederick Henry Bay, plentiful, *W. L. May;* Flinders Island, *Aug. Simson* !.

Genus Spisula, Gray, 1838.

*S. cretacea, Angas, P.Z.S., 1867, t. 44, f. 16.
Tamar Heads (Census); Derwent Estuary, *W. L. May.*

Genus Lutraria, Lamarck, 1799.

*L. rhynchæna, Reeve, Conch. Icon., f. 10.
Bird River to Waterhouse Island; and Circular Head, *W. F. Petterd* !; N.E. Coast (Census).

Family MESODESMATIDÆ.

Genus Anapella, Dall, 1895.

[= *Anapa*, Gray, 1853, non 1847].

*A. cuneata, Lamarck (*Crassatella*), 1818.
Mesodesma cuneata, Reeve, Conch. Icon., f. 7.
A. triquetra, Hanley.
A. Tasmanica, T. Woods, P.R.S.Tasm., 1877, is a micromorph.
A. Smithii, Gray.
Types of *triquetra* and *Tasmanica;* rare in Tasmania (Census); Ralph's Bay and Frederick Henry Bay, *W. L. May.*

Genus Mesodesma, Deshayes, 1830.

*M. erycinæa, Lamarck (*Crassatella*), 1818; Delessert, Recueil, t. 4, f. 4; Reeve, Mon. *Mesodesma*, f. 12.
M. Diemenensis, Q. & G., Voy. Astrolabe, iii., 1835, p. 507, t. 82, f. 12-14.
Type of *M. Diemenensis;* common (Census).

Subgenus Donacilla, Philippi, 1836.

*M. elongata, Deshayes, P.Z.S., 1854, p. 337 ; Reeve, Mon. *Mesodesma*, f. 5.
Very common (Census).

*M. glabrella, Lamarck (*Amphidesma*) !, An.s.Vert., p. 493, 1818.
M. præcisa, Deshayes !, P.Z.S., 1854 ; Reeve, Conch. Icon., f. 31.
M. obtusa, Crosse & Fischer !, Journ. de Conch., 1864, p. 350.
Type of *M. præcisa;* very common (Census).

Family SEMELIDÆ.

Genus SEMELE, Schumacher, 1817.

*S. EXIGUA, A. Adams, P.Z.S., 1861, p. 385; Tate, T.R.S.S. Aust., ix., 1887, p. 85, t. 5, f. 5.
Type; Tamar Heads, *W. F. Petterd*!.

Family PSAMMOBIIDÆ.

Genus GARI, Schumacher, 1817.

*G. ZONALIS, Lamarck (*Psammotæa*), An. s. Vert., v., 1818, p. 517; Reeve, Mon. *Psammobia*, f. 29.
P. striata and *P. compta*, Deshayes, P.Z.S., 1854, p. 321.
Types of *G. striata* and *compta;* common (Census).

Genus SANGUINOLARIA, Lamarck, 1799.

S. VITREA, Deshayes, P.Z.S., 1854, p. 326; Reeve, Mon. *Sanguinolaria*, f. 1, 1857.
Tasmania (*teste* Angas).

Genus SOLENOTELLINA, Blainville, 1824.

[= *Hiatula* (pars), Modeer, 1793, non Martini].

*S. BIRADIATA, Wood (*Solen*), Gen. Conch., t. 33, f. 1, 1815.
S. epidermia and *S. nymphalis*, Reeve, Conch. Icon., t. 1.
Loc. ?; common (Census).

Family TELLINIDÆ.

Genus TELLINA, Linné, 1758.

Subgenus TELLINELLA, Gray, 1852.

*T. DELTOIDALIS, Lamarck, An. s. Vert., v., p. 532 (*ex* var. b.), 1818; Hanley, Mon., t. 59, f. 128, t. 64, f. 229; Delessert, Recueil, t. 6, f. 7, 1841.
Loc. ? (Census); S. Coast, *W. L. May.*

T. DIEMENENSIS, Deshayes, P.Z.S., 1854, p. 361.
Type; very rare (Census).

Section *Pseudoarcopagia*, Bertin, 1878.

*T. **DECUSSATA**, Lamarck, *op. cit.*, p. 532; Hanley, Mon. *Tellina*, t. 62, f. 184; Roemer, Mon., t. 23, f. 1-3.
Bass Straits (Census); Frederick Henry Bay, *W. L. May.*

Section *Peronæa*, Poli, 1791.

*T. **ALBINELLA**, Lamarck, *op. cit.*, p. 524; Hanley, Mon., t. 66, f. 164; Roemer, Mon., t 27, f. 4-7.
Common (Census).

Section *Angulus*, Megerle, 1811.

T. **AUSTRALIS**, Deshayes, P.Z.S., 1854, p. 362.
Type, attributed to Tasmania.

Section *Homala*, Schumacher, 1817.

T. **TRISTIS**, Deshayes, P.Z.S., 1854, p. 361; Reeve, Conch. Icon., t. 64, f. 229.
Type, attributed to Tasmania.

Genus METIS, H. & A. Adams, 1856.

M. **UMBONELLA**, Lamarck (*Tellina*), An. s. Vert., v., p. 532; Hanley, Mon. *Tellina*, t. 56, f. 13.
Type-locality, King Island: Hanley's example is from S. Aust.

Genus MACOMA, Leach, 1819.

*M. **MARIÆ**, Ten.-Woods (*Tellina*), P.R.S.Tasm., 1876, p. 162.
M. rudis, Bertin, Archives Mus. Nat. Hist., 1878, p. 335, t. 9, f. 2.
S. Coast (type); Norfolk Bay and E. Coast, *W. L. May;* Port Phillip (type of *M. rudis*).

Family PETRICOLIDÆ.

Genus CHORISTODON, Jonas, 1844.

*C. **RUBIGINOSUS**, Ad. & Ang. (*Naranio*), P.Z.S., 1863, p. 425, t. 37, f. 17.
Clementia Tasmanica, Petterd, Journ. Conch., 1884, p. 145.
Long Bay and Brown's River !, *W. F. Petterd;* Frederick Henry Bay, *W. L. May.*

Family VENERIDÆ.

Genus Chione, Megerle, 1811.

*C. lamellata, Lamarck (*Venus*), 1818; Delessert, Recueil, t. 11, f. 6.

Canal D'Entrecasteaux (type); common (Census).

*C. gallinula, Lamarck (*Venus*), 1818; Delessert, Recueil, t. 10, f. 1.

King Island (type); common (Census).

*C. australis, Sowerby (*Venus*), P.Z.S., 1835; Reeve, Mon. *Venus*, f. 107; *V. Tasmanica*, Reeve, f. 121.

Bass Straits and S. Coast, rare (Census); type of *V. Tasmanica.*

*C. roborata, Hanley (*Venus*), P.Z.S., 1844; Reeve, Conch. Icon., f. 113.

Venus placcida, Philippi, Abbild. Conch., i., 1844, p. 125, t. 2, f. 2.

Both types Tasmanian; common (Census), and general, *W. L. May.*

*C. lævigata, Sowerby (*Venus*), Thes. Conch., t. 159.

Tapes fumigata, Sowerby.

Rather common (Census); Norfolk Bay, *W. L. May.*

*C. scalarina, Lamarck (*Venus*), 1818; Delessert, Recueil, t. 10, f. 2.

V. aphrodinoides, Lk.; *V. Peroni*, Lk.; *V. conularis*, Lk.

Common (Census).

*C. tristis, Lamarck (*Venus*), 1818; Delessert, Recueil, t. 10, f. 110; Philippi, Abbild. Conch., i., p. 40, t. 1, f. 4.

V. strigosa, Lamarck.

Common (Census); Frederick Henry Bay, *W. L. May.*

*C. striatissima, Sowerby, Thes. Conch., t. 157, f. 102-103; Reeve, Conch. Icon., f. 135.

D'Entrecasteaux Channel ! (Census); Frederick Henry Bay, *W. L. May.*

*C. MACLEAYANA, Ten.-Woods, P.R.S.Tasm., 1879, p. 38.
Bass Straits, King Island, Flinders Island, *Ten.-Woods*; (Hobart Mus. !).

*C. UNDULOSA, Lamarck (*Venus*), 1818; Philippi, Abbild. Conch., i., p. 39, t. 1, f. 1, 1843.
Bruni Island, *W. L. May*.

Genus MERETRIX, Lamarck, 1799.

[=*Cytherea*, Lamarck, 1805].

*M. PLANATELLA, Lamarck, 1818; Philippi, Abbild. Conch., i., p. 199, 1845, t. 3, f. 6.
? *Venus nitida*, Q. & G., Voy. Astrolabe, iii., 1835, p. 529, t. 84, f. 13-14.
Callista Diemenensis, Hanley, P.Z.S., 1844, p. 110.
Cytherea disrupta, Sowerby, Thes. Conch., t. 163, f. 208-209.
Loc. ? (Lamarck's type); Philippi & Deshayes refer it to Insula Van Diemen; Hobart (type of *V. nitida*); Tasmania (type of *C. Diemenensis*); Circular Head, Frederick Henry Bay, and generally distributed, *W. L. May*.

*M. PAUCILAMELLATA, Dunker (*Mercenaria*), 1858, Novitat. Conch.
Venus alata, Reeve, Conch. Icon., f. 83, 1863.
Callista Victoriæ, Ten.-Woods, P.R.S.Tasm., 1876, p. 159.
Frederick Henry Bay !, *Ten.-Woods*; Cloudy Bay, *W. L. May*.

*M. RUTILA, Sowerby, Thes. Conch., ii., t. 103, f. 205.
E. Coast, *W. L. May*.

Genus DOSINIA, Scopoli, 1777.

[=*Artemis*, Poli, 1791].

*D. SCULPTA, Hanley, Cat. Recent Shells, t. 15, f. 42; Reeve, Conch. Icon., f. 52.
D. diana, Ad. & Ang., P.Z.S., 1863, p. 420; *D. coryne*, A. Ad., P.Z.S., 1855, p. 223.
D. immaculata, Ten.-Woods, P.R.S.Tasm., 1876, p. 158 (juv.).
D. grata, T. Woods; *D. Japonica*, Ten.-Woods.
Tasmania (type of *D. coryne*); E. Coast (type of *D. immaculata*);

*D. CIRCINARIA, Deshayes, Cat. Conch. Brit. Mus.; Chall. Rep. Lamell., t. 1, f. 2.

D. grata, Deshayes, *op. cit.*, p. 8; *D. Cydippe*, A. Adams, P.Z.S., 1863, p. 224.

Common (Census); type of *D. Cydippe;* Frederick Henry Bay, *W. L. May.*

Genus SUNETTA, Link, 1807.

[=*Meroe*, Schumacher, 1817].

*S. VAGINALIS, Menke (*Cytherea*), Moll. Nov. Holl., 1843.

Cytherea vaginalis, Philippi, Abbild., iii. p. 96, t. 3. f. 2.

S. Aliciæ, Ad. & Ang., P.Z.S., 1863, p. 425, t. 37, f. 18.

N. Coast, *W. F. Petterd*!.

Genus TAPES, Megerle, 1811.

*T. GALACTITES, Lamarck (*Venus*), 1818; Reeve, Conch. Icon., Mon. *Tapes*, f. 65.

Rupellaria subdecussata, Ten.-Woods, P.R.S.Tasm., 1878, p. 52 (non Deshayes).

Not common (Census).

*T. FABAGELLA, Deshayes, P.Z.S., 1853, p. 10; Reeve, Conch. Icon., f. 66.

Venerupis reticulata !, Ten.-Woods, P.R.S.Tasm., 1876, p. 159.

Tapes Victoriæ, Ten.-Woods, P.R.S.Vict., 1877, p. 59.

Not uncommon on S. Coast, *Ten.-Woods;* Frederick Henry Bay, *W. L. May.*

T. UNDULATA, Born (*Venus*), Index Mus. Vindob., p. 55, 1758.

Venus textile, Gmelin, Lamarck, Philippi, Abbild., iii., p. 77, t. 7, f. 7.

Bass Straits, rare (Census).

Genus VENERUPIS, Lamarck, 1818.

[=*Rupellaria*, auct., non Bellevue, 1802].

*V. CARDITOIDES, Lamarck, 1818; Delessert, Recueil, t. 5, f. 3; Reeve, Conch. Icon., t. 1, f. 5.

Not common (Census); Frederick Henry Bay, *W. L. May.*

*V. crenata, Lamarck, 1818; Delessert, t. 5, f. 2; Reeve, f. 3.
Not common (Census); Port Esperance, *W. L. May.*

*V. Diemenensis, Q. & G., Voy. Astrolabe, t. 84, f. 24-26; Reeve, Conch. Icon., t. 3, f. 17 (good).
Hobart (type !); common (Census).

*V. exotica, Lamarck, 1818; Reeve, Conch. Icon., f. 11.
Frederick Henry Bay, *W. L. May;* King Island !.

*V. mitis, Deshayes, P.Z.S., 1853, p. 5; Reeve, Conch. Icon., f. 24.
King Island and Derwent Estuary, *R. Tate.*

*V. obesa, Deshayes, 1853; Reeve, Conch. Icon., f. 13.
Locality unrecorded,

Family CARDIIDÆ.

Genus Cardium, Linné, 1758.

*C. cygnorum, Deshayes, P.Z.S., 1854, p. 331.
Circular Head, *W. L. May;* River Mersey and Tamar Heads (Census).

*C. pulchellum, Reeve, Mon. *Cardium*, f. 42.
N., E. and S. Coasts, *W. L. May;* loc. ? (Census).

*C. tenuicostatum, Lamarck, 1819; Delessert, Recueil, t. 11, f. 6.
Very common (Census).

Family CHAMIDÆ.

Genus Chama, Bruguière, 1789.

*C. spinosa, Broderip, Trans. Zool. Soc., i., t. 38, f. 8-9.
Circular Head, *W. F. Petterd* !.

Genus Chamostrea, Roissy, 1825.

*C. albida, Lamarck (*Chama*), 1819.
Cleidothærus chamoides, Sowerby, Gen. Shells, f. 1-3.
Sorell, Pittwater, &c., common (Census); Norfolk Bay, *W. L. May;* River Tamar, *Aug. Simson* !.

Family LUCINIDÆ.

Genus Lucina, Bruguière, 1792.

*L. fabula, Reeve, Mon. *Lucina*, f. 69, 1850.
King Island, *R. Tate;* Derwent Estuary, *W. L. May*.

*L. lacteola, Tate, T.R.S.S.Aust., xxi., 1897, p. 48.
L. lactea, A. Ad., P.Z.S., 1855, p. 225 (non Lamarck).
L. concentrica, Ad. & Ang., P.Z.S., 1863, p. 426, t. 37, f. 19 (non Lamarck).
King Island, *R. Tate*.

*L. rugifera, Reeve, Conch. Icon., t. 1, f. 1.
E. Coast, *W. L. May*.

*L. minima, Ten.-Woods, P.R.S.Tasm., 1876, p. 162.
L. Tatei, Angas, P.Z.S., 1878, p. 863, t. 44, f. 15.
Badger Island (type); Frederick Henry Bay, *W. L. May*.

L. divergens, Philippi, 1850, Abbild., iii., t. 2, f. 4.
L. fibula, Reeve, Mon. *Lucina*, f. 33, 37 and 38, 1850.
King Island, rare (Census; *L. pecten*).

*L. perobliqua, Tate, T.R.S.S.Aust., xv., 1892, p. 128, t. 1, f. 10.
Pirate's Bay, *W. L. May*.

Subgenus Divaricella, Martens, 1873.

*L. Cumingi, Ad. & Ang. (*Cyclas*), P.Z.S., 1863, p. 426, t. 37, f 20.
Common (Census).

Genus Loripes, Poli, 1791.

*L. icterica, Reeve, Mon. *Lucina*, f. 60.
Common (Census); King Island, *R. Tate*.

*L. assimilis, Angas, P.Z.S., 1867, t. 46, f. 8.
Loc. ? (Coll. W. F. Petterd !).

Genus Cryptodon, Turton, 1822.

*C. flexuosum, Montague, 1803; Reeve, Mon. *Lucina*, f. 62.
Port Esperance, *Harrisson* ! & *W. L. May;* Off Brown's River, *W. F. Petterd* !.

*C. GLOBOSUM, Forskal, Descript. Anim. Egypte.
Lucina ovum, Reeve, Conch. Icon., f. 21.
Frederick Henry Bay, *W. L. May;* (Coll. W. F. Petterd !).

Family UNGULINIDÆ.

Genus DIPLODONTA, Brown, 1831.

[= *Mysia* (pars), Leach, 1827].

*D. TASMANICA, Ten.-Woods, P.R.S.Tasm., 1877, p. 158. (Pl. xxvii., fig. 102).
Storm Bay and Blackman's Bay, *Ten.-Woods;* Leven Heads, *W. F. Petterd* !; King Island !; D'Entrecasteaux Channel, *W. L. May.*

*D. GLOBULARIS, Lamarck (*Lucina*), An. s. Vert., v., p. 544; Reeve, Mon. *Lucina*, t. 9, f. 53.
Loc. ? (Coll. W. F. Petterd !).

Family ERYCINIDÆ.

Genus KELLYA, Turton, 1822.

*K. ROTUNDA, Deshayes, P.Z.S., 1855, p. 181; Smith, Challenger Exped., t. 21, f. 5, p. 202.
Bass Straits, *W. F. Petterd* !.

*K. SOLIDA, Angas, P.Z.S., 1877, p. 196, t. 26, f. 25.
Frederick Henry Bay, *W. L. May;* loc. ? (Coll. W. F. Petterd !).

*K. ROSTELLATA, Tate, T.R.S.S.Aust., xi., 1889, p. 63, t. xi., f. 14.
King Island, *R. Tate.*

Genus LASÆA, Leach, 1827.

[= *Poronia*, Récluz, 1843].

*L. RUBRA, Montague; *L. scalaris*, Ten.-Woods, non Philippi.
Poronia australis, Sowerby, Journ. de Conch., 1863, p. 287, t. 12, f. 8.
Common (Census); King Island !.

Genus MYLITTA, D'Orb. & Récluz, 1850.

*M. AURICULATA, Smith, Ann. Mag. Nat. Hist., 1891, p. 236, t. 13, f. A-C.
S. Coast, rare, *W. L. May* (type).

*M. DESHAYESI, D'Orb. & Récluz, Journ. de Conch., 1850, p. 292, t. 11, f. 12-14.
Tamar Heads, Flinders Island, Cape Barren Islands, *W. F. Petterd* !; King Island !.

*M. TASMANICA, Ten.-Woods (*Pythina*), P.R.S.Tasm., 1876, p. 162; Tate, T.R.S.S.Aust., ix., 1887, t. 5, f. 12.
King Island (type); Frederick Henry Bay, *W. L. May*.

Genus ROCHEFORTIA, Velain, 1876.

[= *Mysella*, Angas, 1877].

*R. ANOMALA, Angas, P.Z.S., 1877, p. 176, t. 26, f. 22.
South end of Flinders Island, *W. F. Petterd* !.

*R. DONACIFORMIS, Angas, P.Z.S., 1878, p. 863, pl. liv., f. 13.
King Island !.

Genus LEPTON, Turton, 1822.

*L. TRIGONALE, Tate, T.R.S.S.Aust., ii., 1879, p. 131, t. 5, f. 5.
Circular Head, Tamar Heads, King Island, *W. F. Petterd* !.

Genus CYAMIUM, Philippi, 1845.

*C MACTROIDES, Tate & May, T.R.S.S.Aust., xxiv., p. 102, 1900. **(Pl. xxvii., fig. 103).**
Loc. ? (Coll. W. F. Petterd !).

Genus LEGRANDINA, Tate & May (post). **(Pl. xxvii., figs. 98, 99).**

*L. BERNARDI, Tate & May (post).
In the stomach of a mullet (Legrand).

Family CRASSATELLIDÆ.

Genus CRASSATELLA, Lamarck, 1801.

C. AURORA, Ad. & Ang., P.Z.S., 1863, p. 426, t. 37, f. 15.
Banks Straits (type).

C. Banksii, Ad. & Ang., P.Z.S., 1863, p. 427, t. 37, f. 16.
Banks Strait (type).

*C. Kingicola, Lamarck, An.s.Vert., vi., 1819, p. 109; Reeve, Conch. Icon., f. 5.
King Island (type); common, N. (Census); common near Swansea, *W. L. May.*

*C. fulvida, Angas, P.Z.S., 1871, p. 20, t. i., fig. 32.
Frederick Henry Bay, *W. L. May.*

Family CARDITIDÆ.

Genus Cardita, Lamarck, 1799.

*C. amabilis, Deshayes, P.Z.S., 1852, t. 17, f. 8-9.
S. Coast, rather uncommon (Census); E. Coast, *W. L. May.*

*C. bimaculata, Deshayes, *op. cit.*, t. 17, f. 4-5.
C. Gunni, Deshayes, *op. cit.*, p. 101.
C. Atkinsoni, Ten.-Woods, P.R.S.Tasm., 1876, p. 27.
Type of *C. bimaculata*; Long Bay (*C. Atkinsoni*); S. Coast, *W. L. May.*

*C. Quoyi, Deshayes, *op. cit.*, 1852, p. 103.
C. rosulenta, Tate, T.R.S.S.Aust., ix., 1887, p. 69, t. 5, f. 3.
Badger Island, not common (Census).

Section *Mytilicardia*, Blainville, 1821.

*C. aviculina, Lamarck, 1819; Delessert, Recueil, t. 11, f. 12.
C. excavata, Deshayes, P.Z.S., 1852, t. 17, f. 1-3.
M. Tasmanica, Ten.-Woods, P.R.S.Tasm., 1876, p. 161.
King Island (Lamarck's type); D'Entrecasteaux Channel (type of Deshayes); Blackman's Bay (type of Ten.-Woods).

Genus Carditella, E. A. Smith.

*C. elegantula, Tate & May (post).
Blackman's Bay, *W. F. Petterd.*

*C. delta, Tate & May, T.R.S.S.Aust., xxiv., 1900, p. 102; Hedley, Records Aust. Museum, iv., 1900, p. 23, f. 5. (Pl. xxvii., figs. 100, 101).

*C. PECTINATA, Tate & May, T.R.S.S.Aust., xxiv., 1900, p. 103. (Pl. xxvii., figs. 96, 97).
Derwent Estuary, *W. L. May;* King Island !.

*C. ATKINSONI, Ten.-Woods (*Kellia*), P.R.S.Tasm., 1877, p. 158. (Pl. xxvii., fig. 107).
Long Bay (type !); off Brown's River (in 5 fath.), *W. F. Petterd* !.

Family TRIGONIIDÆ.

Genus TRIGONIA, Bruguière, 1789.

*T. MARGARITACEA, Lamarck, Ann. du Mus., iv., p. 355, t. 67, f. 2; Reeve, Conch. Icon., f. 3.
T. pectinata, Lamarck, An.s.Vert., vi., p. 63, 1819.
King Island (type); general, most plentiful at Adventure Bay, *W. L. May*.

Family NUCULIDÆ.

Genus NUCULA, Lamarck, 1799.

*N. OBLIQUA, Lamarck, 1819; Hanley, Mon. *Nuculidæ*, t. 5, f. 150, p. 53.
Oyster Cape (type); Long Bay, very rare (Census); not uncommon in Port Esperance at 24 fathoms, *W. L. May*.

*N. ANTIPODUM, Hanley, P.Z.S., 1860; Mon. *Nuculidæ*, f. 155.
N. minuta, Ten.-Woods, P.R.S.Tasm., 1877, p. 156 [*nom. præocc.*].
N. micans, Angas, P.Z.S., 1878, p. 864, t. 44, f. 16.
Australia (type-species); Blackman's Bay (*N. minuta*); S. and E. Coasts, *W. L. May*.

Genus LEDA, Schumacher, 1817.

*L. CRASSA, Hinds (*Nucula*), P.Z.S., 1843, p. 99; Hanley, Mon. *Nuculidæ*, f. 69; Reeve, Mon. *Leda*, f. 27.
L. chuva, Forbes, Voy. Fly, t. 2, f. 3; Hanley, f. 67; Reeve, f. 42.
Tasmania (type of *L. chuva*); rather uncommon (Census); Frederick Henry Bay, *W. L. May*.

*L. ENSICULA, Angas, P.Z.S., 1877, p. 177, t. 26, f. 27.
L. Lefroyi, Beddome, P.R.S.Tasm., 1881, p. 21.

D'Entrecasteaux Channel (Colls. Beddome !, Hull !, Petterd ! and May !).

Genus AUSTROSAREPTA, Hedley, 1899.

*A. PICTA, Hedley, P.L.S.N.S.W., xxv., p. 430, wdcts.
Montacuta variegata, Brazier, MS., P.L.S.N.S.W. (2), ix., p. 179.
Frederick Henry Bay, *W. L. May*.

Family ARCIDÆ.

Genus BARBATIA, Gray, 1840.

*B. CARPENTERI, Dunker (*Anomalocardia*), Nov. Conch., 1860, t. 30, f. 7-9.
B. radula, Smith, Challenger Reports, p. 260, t. 17, f. 3, 1885.
Hobart Mus. ! (*A. trapezia* and *A. fasciata*); Bass Straits, Tamar Heads, S. Tasmania (Census).

*B. TRAPEZINA, Lamarck (*Arca*); Delessert, Recueil, t. 11, f. 13.
Arca lobata, Reeve, Conch. Icon., t. 3, f. 3.
King Island (type); Tamar Heads (Census); Frederick Henry Bay, *W. L. May*.

*B. SQUAMOSA, Lamarck (*Arca*), An.s.Vert., vi., p. 45.
Arca pusilla, Sowerby, P.Z.S., 1833, p. 18. N.S. Wales and Queensland.
Barbatia laminata, Angas, P.Z.S., 1865, p. 13. S. Aust.
Arca McCoyi, Ten-Woods, P.R.S.Vict., 1877, p. 60. Vict.
King Island (Lamarckian type); E. and S. Coasts, *W. L. May*.

Genus GLYCYMERIS, Da Costa, 1778.

[= *Pectunculus*, Lamarck, 1801].

*G. GEALEI, Angas, P.Z.S., 1873, p. 183, t. 20, f. 5.
P. orbicularis, Angas, P.Z.S., 1879, p. 420, t. 35, f. 5 (junior).
P. flabellatus, Ten.-Woods, P.R.S.Vict., 1877, p. 61.
P. Beddomei, Smith, Voy. Challenger, p. 252, t. 18, f. 1, 1885.
Bird River to Waterhouse Island, *W. F. Petterd* !; Flinders Island, *R. M. Johnston* !.

*G. RADIANS, Lamarck (*Pectunculus*), An.s.Vert., vi., p. 54.
P. obliquus, Reeve, Conch. Icon.

*G. **STRIATULARIS**, Lamarck (*Pectunculus*), An.s.Vert., vi., 1819, p. 52; Reeve, Conch. Icon., i., pl. vi., f. 27.
Swansea, E. Coast, *W. L. May;* very common (Census; *A. radians*).

G. **HOLOSERICA**, Reeve, Conch. Icon., f. 18.
No locality.

Genus LIMOPSIS, Sassi, 1827.

*L. **RUBRICATA**, Tate, T.R.S.S.Aust., ix., 1887, p. 71, t. 5, f. 6.
Pirate's Bay, *W. L. May.*

*L. **MULTISTRIATA**, Forskal, Descript. Anim. Egypte.
? *L. MacGillivrayi*, A. Ad., P.Z.S., 1862, p. 230.
L. Belcheri, McCoy, Prod. Pal. Vict., ii., t. 19, f. 8-9, 1875; non Adams & Reeve.
L. cancellata, Ten.-Woods, P.R.S.Tasm., 1877, p. 156 (non Reeve) = *L. Tenisoni*, *op. cit.*, 1878, p. 56.
N. Coast, *Ten.-Woods;* Frederick Henry Bay, *W. L. May.*

L. **BASSI**, Smith, Voy. Challenger, t. 18, f. 6, p. 256, 1885.
[*Cucullæa concamerata* ! is subfossil at Flinders Island; recorded as *C. Corioensis* by R. M. Johnston.]

Family MYTILIDÆ.

Genus MYTILUS, Linné, 1758.

*M. **HIRSUTUS**, Lamarck, 1819; Reeve, Conch. Icon., f. 8.
Rare (Census); George Bay, E. Coast, *W. F. Petterd* !.

*M. **MENKEANUS**, Philippi; Reeve, Conch. Icon., t. vii., f. 26.
Clark's Islands, S. Flinders Island; Port Arthur, *W. F. Petterd* !; Blackman's Bay, very common, *W. L. May.*

*M. **PLANULATUS**, Lamarck !, An.s.Vert., vi., p. 125, 1819.
M. Tasmanicus, Ten.-Woods, P.R.S.Tasm., 1876, p. 161 (adult); *M. latus*, Ten.-Woods, *op. cit.*, 1877, p. 54.
M. Dunkeri, Reeve, Conch. Icon., t. 5, f. 17.
Hobart, common (Census); Storm Bay (*M. Tasmanicus*).

*M. **ROSTRATUS**, Dunker, P.Z.S., 1856, p. 358; Reeve, Conch. Icon., f. 15.

Type (Brit. Mus.); common (Census); Frederick Henry Bay, *W. L. May.*

Genus MODIOLA, Lamarck, 1801.

*M. ALBICOSTA, Lamarck, 1819; Delessert, Recueil, t. 13, f. 8; Reeve, Conch. Icon., t. 2, f. 7.

Common (Census); E. and S. Coasts, *W. L. May.*

*M. ARBORESCENS, Chemnitz; Sowerby, Gen. Shells, f. 1; Reeve, Conch. Icon., t. 6, f. 30.

Long Bay, very rare (Census); Loc. ? (Coll. C. E. Beddome!); Port Esperance, *W. L. May.*

*M. AUSTRALIS, Gray, King's Survey, Aust., ii., p. 477, 1827; Reeve, Conch. Icon., t. 5, f. 21.

M. tulipa, var., Lamarck; *M. albicosta*, var. *spatula*, Lamarck.

Loc. ?; common (Census).

*M. INCONSTANS, Dunker (*Volsella*), P.Z.S., 1856, p. 363.

M. semivestita, Tate, T.R.S.S. Aust., ix., p. 106, t. 5, f. 16a-b, 1887 (non Dk.).

Tasmania (type); Derwent Estuary, *W. L. May.*

*M. [illegible], Angas [illegible], P.Z.S., 1871, p. 21, t. 1, f. 33.

M. [illegible], Ten.-Woods, P.R.S. Tasm., 1877, p. 157.

[illegible] Heads, [illegible] Adventure Bay, abundant, *Ten.-Woods*; [illegible] Frederick Henry Bay, common, *W. L. May.*

Genus MODIOLARIA, Lovén, 1846.

*M. BARBATA, Reeve, Mon. *Lithodomus*, t. 5, f. 27; *Lith. lanigerus*, Reeve.

Frederick Henry Bay and E. Coast, *W. L. May.*

*M. CUMINGIANA, Reeve, Mon. *Modiola*, t. 9, f. 50.

Long Bay and Tamar Heads, not common (Census); Frederick Henry Bay, *W. L. May.*

M. VEXILLUM, Reeve, Mon. *Modiola*, t. 8, f. 40, 1857.

Volsella picta, Dunker, P.Z.S., 1856, non Lamk.

Tasmania (type).

*M. PAULUCCIÆ, Crosse (*Crenella*), Journ. de Conch., 1863, p. 89, t. 1, f. 8.
Frederick Henry Bay, *W. L. May*.

Genus ARCOPERNA, Conrad, 1865.

*A. RECENS, Tate, Malac. Soc., ii., 1897, p. 181, 3 wdcts.
Port Esperance (type !), *Harrisson & May*.

Genus MODIOLARCA, Gray, 1847.

*M. TASMANICA, Beddome, P.R.S.Tasm., 1881, p. 168. (Text fig. 12.)
Cloudy Bay, S. Bruni Island, and off Brown's River, *Beddome*.

Family PHILOBRYIDÆ.

Genus PHILOBRYA, Carpenter.

*P. CRENATULIFERA, Tate (*Myrina*), T.R.S.S.Aust., 1892, t. 1, f. 11, 11*a*.
Frederick Henry Bay, *W. L. May;* Flinders Island, *G. B. Pritchard* ! *;* King Island !.

*P. FIMBRIATA, Tate, T.R.S.S.Aust., xxii., 1898, t. 4, f. 8.
Derwent Estuary and Frederick Henry Bay, *W. L. May*.

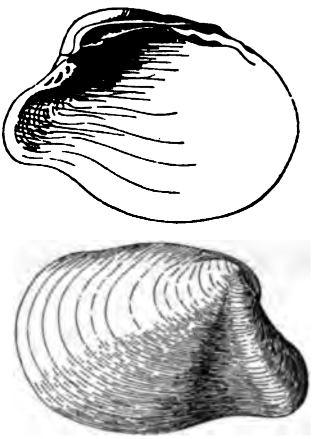


Fig. 12—*M. Tasmanica*.

Family PTERIIDÆ.

Genus PTERIA, Scopoli, 1777.

[= *Avicula*, Bruguière, apud Klein].

*P. PAPILIONACEA, Lamarck, An.s.Vert., vi., p. 149, 1819.
A. Georgiana, Q. & G., iii., p. 457, t. 77, f. 10-11.
A. pulchella, Reeve, Conch. Icon., f. 22.
Common (Census).

*P. ZEBRA, Reeve, Mon. *Avicula*, f. 36.
King Island, *R. Tate*.

Genus VULSELLA, Lamarck, 1799.

*V. OVATA, Lamarck, An.s.Vert., vi., p. 222.
V. Tasmanica, Reeve, Conch. Icon., t. 1, f. 3 (is a slight variant).
Type of *V. Tasmanica;* common (Census).

Family PINNIDÆ.

Genus PINNA, Linné, 1758.

*P. TASMANICA, Ten.-Woods, P.R.S.Tasm., 1876, p. 161.
N. Coast (type); Circular Head and E. Coast, *W. L. May.*

Family SPONDYLIDÆ.

Genus SPONDYLUS, Linné, 1758.

*S. TENELLUS, Reeve, Conch. Icon., t. 18, f. 67.
N. Coast, rare (Census); Circular Head, *W. L. May.*

Family LIMIIDÆ.

Genus LIMA, Bruguière, 1792.

*L. MULTICOSTATA, Sowerby, in Reeve's Conch. Icon, f. 4.
Not common (Census); S. and E. Coasts, *W. L. May.*

Subgenus LIMATULA, S. Wood, 1839.

*L. BULLATA, Born; Sowerby, Gen. Shells, f. 3; Reeve, Mon. *Lima*, f. 3.
N. Coast (Census); S. Coast, *W. L. May.*

Family PECTENIDÆ.

Genus PECTEN, Lamarck, 1799.

*P. BIFRONS, Lamarck, 1819; Delessert, t. 15, f. 5; Reeve, Conch. Icon., f. 45.
P. Tasmanicus, Ad. & Ang., P.Z.S., 1863, p. 428, is a senile form !.
Common (Census).

*P. ASPERRIMUS, Lamarck, 1819; Delessert, t. 15, f. 1.
P. australis, Reeve, Conch. Icon., f. 75.
King Island ! (type); very common (Census).

*P. UNDULATUS, Sowerby.
P. Mariæ, Ten.-Woods, P.R.S.Tasm., 1876, p. 158.
Tasmania (type); Maria Island, *Ten.-Woods;* N. and E. Coasts, *W. L. May*, *W. F. Petterd*, *T. Hull* !.

*P. ACTINOS, Petterd, P.R.S.Tasm., 1886, p. 320.
N. E. Coast and King Island (type !); Circular Head, *W. L. May*.

*P. FUMATUS, Reeve, Conch. Icon., t. 7, f. 32.
George's Bay, N.E. Coast, *Aug. Simson* !.

*P. MERIDIONALIS, Tate, P.R.S.Tasm., 1887, p. 115.
P. laticostatus, Ten.-Woods, non Gray.
Loc. ? (type); E. and S. Coasts, *W. L. May*.

Family ANOMIIDÆ.

Genus PLACUNANOMIA, Broderip, 1832.

*P. IONE, Gray, P.Z.S., 1849, p. 123; Reeve, Mon. *Anomia*, f. 6.
Circular Head, *W. F. Petterd* !.

Family OSTREIDÆ.

Genus OSTREA, Linné, 1758.

*O. ANGASI, Sowerby in Reeve's Conch. Icon., t. 13, f. 28. The southern analogue of *O. edulis*.
E. and S. Coasts, *W. L. May;* (Census).

O. GLOMERATA, Gould, Proc.Bost., Soc. N. Hist., iii., p. 346, 1850; U.S. Expl. Exped., xii., p. 461, pl. 43, f. 577; Reeve, Conch. Icon., f. 52.
Not common (Census).

Class PALLIOBRANCHIATA.

Family TEREBRATULIDÆ.

Genus MAGELLANIA, Bayle, 1880

[= *Waldheimia*, King, 1850; non Brullé, 1846].

*M. FLAVESCENS, Lamarck (*Terebratula*), 1819.
Terebratula australis, Q. & G., Voy. Astrolabe, t. 85, f. 1-5, 1835.
N. Coast (Census).

Genus KRAUSSINA, Davidson, 1859.

[=*Kraussia*, Davidson, 1852; non Dana].

*K. ATKINSONI, Ten.-Woods (*Kraussia*), P.R.S.Tasm., 1878, p. 57. *Kraussina Atkinsoni*, Davidson, Tr. Linn. Soc. (2), iv., 1887, p. 127, t. 21, f. 5-6; Twelvetrees & Petterd, P.R.S.Tasm., 1900, p. 90, f. 4.

Type, Long Bay, D'Entrecasteaux Channel.

Subgenus MEGERLINA, Deslongchamps, 1884.

*K. LAMARCKIANA, Davidson, P.Z.S., 1852, p. 80, t. 14, f. 22-23.

Tamar Heads (Census); D'Entrecasteaux Channel, *W. L. May.*

Genus MAGASELLA, Dall, 1870.

*M. CUMINGI, Davidson, Tr. Linn. Soc. (2), iv., pt. ii., p. 97, t. xvii., figs. 22-23.

Loc.? (Coll. W. F. Petterd!); near Swansea, E. Coast, *W. L. May.*

SUMMARY OF ADMITTED SPECIES.

Class Cephalopoda		10
Gasteropoda—		
Subclass Prosobranchiata	448	
Polyplacophora	24	
Opisthobranchiata	19	
Nudibranchiata	1	
Pulmonifera	12	
	—	504
Scaphopoda		4
Lamellibranchiata		157
Palliobranchiata		4
Total		679

iv.—SYNONYMS APPLIED TO TASMANIAN SPECIES, WITH THEIR ADOPTED NAMES; AND SPECIES WRONGLY ATTRIBUTED TO TASMANIA.*

CEPHALOPODA.

Argonauta oryzata, Meuschen=*A. nodosa.*
Spirula lævis, Gray=*S. australis.*

GASTEROPODA.

Acanthochætes zelandicus, T. Wds.=*Acanthochites asbestoides.*
Acanthochites Coxi, [Pilsb.], Lodder: not admitted.
Actæopyramis concinna, A. Ad.=*Adelactæon casta.*
Acus [=*Terebra*] *bicolor.*†
Adeorbis picta, T. Wds., not Tasmanian.
Æsopus [=*Columbella*] *filosa*, apud T. Wds.†
Alaba spp.=*Diala* spp.
Alexia Harrissoni, Bedd.=*A. meridionalis.*
Alvania spp.=*Rissoia* spp.
Ampullarina minuta, T. Wds.=*Natica* sp. indet.
    „ *Tasmaniæ*, Le Guillou: species unrecognised.
Ancillaria fusiformis, Petterd=*Ancilla oblonga.*
    „ *mucronata* (pars), T. Wds.=*Ancilla hebera* (a Table Cape fossil).
    „ *obtusa*, Petterd=*Ancilla Petterdi.*
Aplysia Tasmanica [Bedd.], Lodder: nomen nudum.
Bankivia varians, Beck=*B. fasciata.*
Birostra MacCoyi, T. Wds., is not Tasmanian.

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* Synonyms mentioned in the Systematic List (Part iii.), for the sake of brevity have not been repeated in the following list.—[ED.].

† To save the repetition of specific names entries of the character of

Acus bicolor=*Terebra bicolor*,
Æsopsus filosa, apud T.Wds.=*Columbella filosa*

have been abbreviated so as to read as in the text above, or as

Chiton [=*? laxiphora*] *petholatus (a)*

when a change in the gender of the adjective is involved.—[ED.].

Cadulus Petterdi, nom. nud.=*C. acuminatus*.
Callomphala [=*Neritula*] *lucida*.
Cantharidus [=*Bankivia*] *fasciatus (a)*.
,, *Peroni*=*Phasianotrochus eximius*, color var.
Cassis achatina, apud Lodder=*Semicassis pyrum*.
,, *Ceylonica*, Paetel: undescribed.
Ceratia [=*Rissopsis*] *McCoyi*.
,, *Mariæ*, T. Wds.: *nom. nud.*
,, *punctato-striata*, T. Wds.=*Leucotina casta*.
Cerithidea [=*Batillaria*] *Diemenensis*, Paetel.
Cerithiopsis [=*Newtoniella*] *albosutura*.
,, [= ,,] *Angasi*.
,, *Atkinsoni*,=*N. crocea*.
,, *clathrata*.=*N. Angasi*.
,, [=*Newtoniella*] *crocea*.
,, *Johnstoni*,=*N. crocea*.
,, *purpurea*,=*N. albosutura*.
,, *ridicula*=*C. minima*.
Chiton aereus, Rve., apud Lodder: belongs to New Zealand.
,, *albidus*, Blainv.=*Plaxiphora* sp., unrecognisable.
australis, T. Wds.=*Ischnoradsia Novæ-Hollandiæ*.
,, *Coxi*, Pilsbry, apud Lodder=*C. jugosus*.
,, *lineolatus*, Blainv.=*Chiton* ? sp., unrecognisable.
,, *muricatus*, Adams, apud Lodder=*C. limans*, Sykes, not confirmed.
,, [=*Plaxiphora*] *petholatus (a)*.
,, *piceus*, T. Wds.=? *Liolophura Gaimardi*, not confirmed.
,, *proteus*, T. Wds.=*Ischnochiton fruticosus*.
,, *Sinclairi*, [Gray] T. Wds.=*C. pellisserpentis*.
,, *speciosus*, T. Wds.=*Ischnochiton contractus*.
,, *Tasmanicus* [Carpenter], Paetel, is not known.
,, *tulipa*, Q. & G.: belongs to Cape of Good Hope.
,, *Zelandicus* (Q. & G.), T. Wds.=*Acanthochites asbestoides*
Cingula [=*Rissoia*] *Atkinsoni*.
,, [=*Rissoia*] *Mariæ*, T. Wds.
Cingulina australis, T. Wds.=*Rissoia Tenisoni*

Cirsotrema varicosa is not Tasmanian (*teste* W. F. Petterd).
Clanculus conspersus, Ang., non Ads.=*C. Yatesi.*
„ *nodoliratus*, A. Ads.=*C. plebeius.*
„ *nodulosus*, A. Ads., is not Australian.
„ *ringens*, Menke: wrongly assigned by Tryon.
Clathurella Browniana, T. Wds. MS.=*Mangilia alucinans.*
„ *parvula*, G. B. Sow.=*C. philomenæ.*
Concholepas foliaceus, Q. & G.=*Hipponyx antiquatus.*
„ *subrufa* (Sow.), T. Wds.=*Hipponyx Danieli.*
Colina [=*Ataxocerithium*] *rhodostoma*, Paetel.
Columbella achatina, apud Lodder=*C. tenuis.*
„ *impolita*, Sow.=*C. austrina.*
„ *infumata*, Crosse !=*C. semiconvexa.*
„ *pilosa*, T. Wds.=*C. filosa.*
„ *saccharata*, Rve.=*C. semiconvexa.*
„ *Tayloriana*, Tryon=*C. albomaculata.*
„ *Tenisoni*, Tryon=*C. Angasi.*
„ *unisulcata*, Kobelt=*C. miltostoma.*
Cominella [=*Agnewia*] *tritoniformis.*
Conus pontificalis, Lk.: wrongly assigned.
„ *Tasmaniæ*, Sow.: doubtfully Tasmanian.
Cremnobates corneus, Sw.=*Ophicardelus australis.*
„ [=*Ophicardelus*] *parvus*, Sw.
„ *solida*, Sw.=*Marinula patula.*
Crepidula onyx, apud Lodder=*C. unguiformis.*
Cryptoplax spinosa, A. Ads.=*C. striatus*, var.
Cyclostrema [=*Skenea* ?] *Bruniensis*, Bedd.
„ *Kingii*, Brazier, apud Lodder: nomen nudum.
„ *microtata*, Petterd, apud Lodder: nomen nudum.
„ *spinosa*, T. Wds.=*Astralium* sp. (junior).
„ *Susonis*, T. Wds.=*C. australe.*
„ *Tatei*, Lodder, non Angas=*C. Harrietta.*
Cypræa annulus is not Tasmanian.
„ *pulicaria*, Rve.: attributed to Tasmania by Paetel; not known.
„ *Scotti*, Broderip: not Tasmanian.

Daphnella bitorquata, G. B. Sow.=*D. Legrandi.*
Diala Johnstoni, Paetel=*Cerithiopsis Johnstoni*=*C. crocea.*
,, *varia*, A. Ads.=*D. semistriata.*
Diaphana nivea, Petterd=*Cypraea* sp. (juv.).
Diloma atrovirens, Philippi, belongs to N. Zealand.
Drillia Angasi, Lodder non Crosse=*D. Beraudiana.*
,, [=*Daphnella*] *minuta*, T. Wds.
,, *Sinensis*, Lodder non Hinds=*D. Coxi.*
,, *Weldiana*, T. Wds., is a tropical shell (*teste* Rev. H. T. Hull).
Elenchus spp.=*Phasianotrochus* spp.
Emarginula tenuicostata, T. Wds.=*Subemarginula rugosa.*
Euoplochiton undulatus=*Onithochiton undulatus*: belongs to New Zealand.
Ethalia Tasmanica, T. Wds., is not Tasmanian.
Euchelus canaliculatus, T. Wds.=*E. baccatus.*
Eulima Legrandi, Beddm.; type lost, species unrecognisable.
,, *Lodderae*, Tate, MS., apud Lodder=*E. bivittata.*
Fasciolaria trapezium, Linné, is not Tasmanian.
Fissurella australis, Krauss=*Capiluna lineata.*
,, *mus*, Paetel : undescribed.
,, *ossea*, Sow. (non Gould)=*Tugalia parmophoidea.*
,, *Tasmaniensis*, Bonnet=*Megatebennus trapezinus.*
Fissurellidea [=*Lucapinella*] *nigrita* [Sow.], Paetel.
Fossarus [=*Minos*] *Petterdi*, Paetel.
,, *Tasmanicus*, T. Wds.=*Euchelus scabriusculus* (juv.).
Fusus spectrum, apud Lodder=*F. Novæ-Hollandiæ.*
Galerus calyptræiformis, Paetel=*Calyptræa tomentosa.*
Gibbula australis, [T. Wds]. Paetel=*G. Tiberiana.*
,, *depressa*, T. Wds.=*Diloma Adelaidæ* (jun.).
,, *dolorosa*, T. Wds.=*D. Adelaidæ* (?).
,, *sulcosa*, A. Adams, is an unfigured species of N. Australia.
,, *solorosa*, Lodder : typographic error for *dolorosa.*
Glyphis spp.=*Fissuridea* spp.
Glyphostoma [=*Mangelia*] *paucimaculata.*

Haliotis ancilis, Rve. } attributed by Paetel to Tasmania; not
,, *astricta*, Rve. } known.
,, *carinata*, T. Wds.=*H. Emmæ.*
,, *elegans*, Koch: Swainson's record not confirmed.
Haminea cymbalum, Angas }
,, *obesa*, T. Wds. } =*H. tenera.*
,, *Zealandiæ*, apud Lodder }
Hastula [=*Terebra*] *Brazieri.*
Hipponyx subrufa, apud Lodder=*H. Danieli.*
Ianthina bipartita, Gray: identification doubtful.
Ischnochiton australis=*I. Novæ-Hollandiæ*, non *I. australis*, Sow.
,, *divergens*=*I. fruticosus.*
Lamellaria indica, apud Lodder=*Marsenia ophione.*
,, [=*Marsenia*] *ophione.*
Lepidopleurus speciosus, Ad. & Ang.=*Ischnochiton decussatus.*
Liotia annulata, Tate (pars)=*L. compacta.*
,, *clathrata*, apud Lodder } =*L. subquadrata.*
,, *discoidea*, T. Wds. }
,, *lamellosa*, T. Wds.=*L. subquadrata.*
,, *Mayana*!, Tate: incorrectly attributed to Tasmania.
,, *siderea*, Ang.=*L. Tasmanica.*
,, *speciosa*, Ang.=*Pseudoliotia micans.*
Litiopa [=*Diala*] *lauta.*
,, [= ,,] *semistriata.*
Littorina Eddiæ, Petterd, MS.=*L. erronea*, Nevill: introduced to Kelso.
,, *Hisseyana*: see pp. 449, 457.
,, *nodulosa*=*Tectaria nodulosa.*
,, *punctata*, Gmel., apud Lodder, is not Australian.
,, *undulata*, Gray=*L. Mauritiana.*
Lophyrus [=*Ischnoradsia*] *australis*, Rve.
Lorica volvox is quoted by Miss Lodder, perhaps on the faith of earlier but false identifications.
Lunella [=*Turbo*] *undulata (us).*
Mangilia gracilina, T. Wds.,MS.=*M. Adcocki.*
,, *pseudocarinata*, Rve., is not confirmed.

Marginella volutiformis, Sow. = *M. pygmaea*.

Marsenia solida = *M. ophione*.

Megalatractus maximus, Tryon = *Siphonalia Tasmaniensis*.

Megatebennus [= *Fissurellidaea*] *concatenatus* (*a*), apud Lodder.

Metula [= [illegible]] *reticulata*, Paetel.

Microsetia spp. = *Rissoia* spp.

Minolia [= *Fossarina*] *funiculatus* (*a*), Lodder.

„ [= *Gibbula*] *Legrandi*, Lodder.

Mitra Capensis, Lodder, apud Dunker = *M. Tenesia*.

„ *granatina*, T. Wds., is not Tasmanian.

„ *semilirata*, T. Wds. = *M. Tenesia*.

„ *Tatei*, Angas = *M. Legrandi*.

„ *testacea*, Swainson = *M. badia*.

Monilea turbinata, T. Wds.: doubtfully Tasmanian, related to *M. lentiginosa*.

Monodonta Adelaidae, Phil. } = *Diloma Adelaidae*.
„ *australis*, T. Wds. }

„ *crinita*, Phil., belongs to N. Zealand.

„ [= *Diloma*] *odontis*, Wood.

„ *reticularis* [Wood], Paetel, belongs to N. Zealand.

„ *striata*, Q. & G. = ***Trochocochlea australis***.

„ *zebra*, Phil. = *T. constricta*, var.

Murex [illegible] is casually introduced to Flinders Id. (R. M. Johnston).

Nassa Jonasi, apud Lodder = *N. Burchardi*.

„ [illegible], apud Lodder = *N. Jacksoniana*.

Natica [illegible], Reeve = *N. ampla*.

„ *Strangei*, T. Wds. = *N. ampla*.

Neptunea [= *Siphonalia*] *Tasmaniensis*, apud Paetel.

Nerita neritinoides is wrongly attributed by Paetel.

„ *punctata* (Q. & G.), Lodder = *N. melanotragus*.

Onithochiton undulatus, Q. & G., Van Dieman's Land, Gray, in Moll. Brit. Mus., belongs to New Zealand.

Pachypoma [= *Astralium*] *aureum* [Jonas], Paetel.

Patella decora, Phil. = *P. stellaeformis*.

Pirenella [= *Batillaria*] *Diemenensis*, Paetel.

Planifora [=*Plaxiphora*] *petholata*, T. Wds.
Pollia Petterdi is not Tasmanian.
Pomatiopsis badgerensis, R. M. Johnston } =*Coxiella confusa.*
„ *striatula*, Cox. }
Purpura albosutura [T. Wds.], Lodder=*Cominella albolirata.*
„ *madreporarium*, Sow., is not Tasmanian.
Ricinula spp.=*Sistrum* spp.
„ *undata*, Lodder, non Chem.=*S. reticulatum.*
Risella picta [Phil.]. Paetel=*R. melanostoma.*
Rissoia elegans, Angas=*R. cheilostoma.*
„ *Hisseyana* [T. Wds.], Lodder : tip of a *Trochoid* shell.
„ *plicata*, Hutton=*R. cheilostoma.*
„ *punctatostriata*, T. Wds.=*Leucotina casta.*
„ *torcularis*, [T. Wds.] Tate : is not Tasmanian.
Rissoina Angasi, Pease=*R. flexuosa.*
„ *approxima*, Petterd=*Rissoia approxima.*
„ *concatenata*, T. Wds. : species undefinable.
„ *lirata*, Angas=*R. nivea.*
„ *striata*, Q. & G., non Gray, apud Lodder, is not Australian.
„ *toxopleura*, Tate=*R. nivea.*
„ [=*Rissoia*] *suprasculpta*, T. Wds.
Rotella infraplanata [Sow.], Paetel, is not Australian.
Scalaria cancellata, Tryon, attributed to T.-Wds., is undescribed.
„ *varicosa*, Lk , is wrongly attributed (*teste* W. F. Petterd).
Schizochiton nympha, Rochebrun, is unrecognisable.
Scutellastra Chapmani, T. Wds.=*Patella stellæformis.*
Senectus circularis, Rve.=*Turbo Gruneri.*
„ *filosus*, Kiener, is not known.
Setia [=*Assiminea*] *Brazieri*, T. Wds.
„ *flamia*, Bedd.=*Rissoia Beddomei.*
„ *Siennæ*, T. Wds.=*Assiminea Tasmanica.*
Sigaretus australis [Hanley], Paetel=*S. zonalis.*
Solarium infundibulum has been imported from Bird Island, N. Australia.
Stylifer Tasmanicus, T. Wds.=*Petterdella Tasmanica.*
Syrnola varians, Tate & May=*S. suprasculpta*, (*teste* J. H. Gatliff).

Terebra fictilis, Lodder, non Hinds=*T. bicolor.*
,, [=*Daphnella*] *Harrissoni*, Lodder.
,, *Jukesii*, Lodder }
,, *Kieneri*, Deshayes } =*T. addita*
,, *nitida* (pars), Rve.=*T. plicatella*, Deshayes, is wrongly assigned.
,, *spectabilis*, Tryon=*T. addita.*
Thalotia [=*Cantharidus*] *Baudini*, Paetel.
,, *dolorosa*, T. Wds.=*Diloma Adelaidæ.*
Trachyradsia inornata=*Callochiton inornatus.*
Triton spp.=*Lampusia* spp.
,, *nodiferus*, apud Lodder=*L. australis.*
Tritonidea Petterdi, Angas, is from Bird Island, N.E. Australia (*teste* W. F. Petterd).
Trochita calyptræformis=*Calyptræa tomentosa.*
Trochocochlea chloropoda, Tate=*T. melanoloma.*
,, *compta*, T. Wds. : nomen nudum.
Trochus [=*Astralium*] *aureus*(*um*).
,, *australis*, T. Wds.=*Diloma Adelaidæ.*
,, *Peroni*, Phil.=*Phasianotrochus eximius.*
,, *porcatus*, A. Ad.=*Trochocochlea constricta*, var.
,, *Preissi*, Menke=*Cantharidus pulcherrimus.*
Trophon Mariæ, T. Wds. : nomen nudum.
Truncatella Ceylonica, Pfeiffer=*T. teres* } not actually known
,, *micra*, T. Wds.=*T. Ceylonica* } in Tasmania.
Tugalia australis, T. Wds. }
,, *intermedia*, Rve. } =*T. parmophoidea.*
,, *Tasmanica*, T. Wds. }
Turbo cucullata, T. Wds., is probably exotic.
,, *filosus* [Kiener], Paetel, is not known.
Turritella constricta, Rve.=*T. clathrata.*
,, *incisa*, Rve., is not known.
,, *incisa*, T. Wds.=*T. Sophiæ.*
,, *Sophiæ*, Brazier, is not known.
,, *subsquamosa*, Dunk., is not Tasmanian.
,, *Tasmanica*, Rve.=*T. lamellosa* (?).

Umbonium Tasmanicum, T. Wds., 1880, is not Tasmanian.
Vermetus dentiferus=*Thylacodes sulcatus.*
Zizyphinus granulatus, T. Wds.=*Calliostoma Meyeri.*

Class LAMELLIBRANCHIATA.

Amphichæna [=*Gari*] *modesta* : not confirmed.
Anaitis [=*Chione*] *lamellosa*, Rom.
Anatina maritina, apud Paetel, is not known.
,, *anserifera*, apud Reeve & Gunn, is an error of locality.
Arca pistachia, Lk. : type attributed to King Id.; species unrecognised.
,, *semitorta*, Lk. : type attributed to King Id.; doubtless a mistake.
Arcopagia [=*Pseudoarcopagia*] *decussata.*
Avicula hyalina, Dunker } =*Pteria papilionacea.*
,, *scalpta*, Rve. }
Azara triquetra [Hanley], Paetel=*Anapella cuneata.*
Barbatia Domingensis is the Atlantic type of *B. squamosa.*
Callista candida, Desh., is wrongly attributed to Australia.
,, *citrina*, Lamk., is wrongly attributed to Tasmania.
,, *multistriata* belongs to New Zealand.
Cardita Preissi, Menke, is wrongly attributed by Paetel.
Cardium papyraceum is not actually known.
Chama fragum, Rve.=*C. spinosa.*
Chione aphrodina, Lk.=*C. scalarina.*
,, *Stutchburyi*, Gray, is wrongly attributed to Tasmania.
Circumphalus lamellatus, Lk.=*Chione lamellatus.*
Corbula erythrodon, Lk. } not known in Tasmania.
,, *zelandica*, Q. & G. }
Crenatula modiolaris, Lk. : type from Maria Id., but doubtless a mistake.
Dosinia coerulea, Rve., is not Tasmanian.
,, *incisa*, Rve. } =*D. scabriuscula*, not Tasmanian.
,, *Japonica*, Rve. }
,, *ponderosa* [Gray], apud Kenyon, is not Australian.
,, *scabriuscula* is not Tasmanian.

Gari Atkinsoni, Brazier: nomen nudum.
Gouldia Petterdi, T. Wds. } =*Myochama Tasmanica.*
,, *Tasmanica*, T. Wds. }
Hiatula florida, Gould=*Solenotellina donacioides*: not recognised.
,, [=*Sanguinolaria*] *vitrea*, Deshayes.
Kuphus arenarius, Linné: Van Dieman's Land, not Tasmania.
Limopsis Bassi, E. A. Smith, is not recognised.
Loripes assimilis: ? Tasmanian.
,, [=*Cryptodon*] *globosum.*
Lucina divaricata, T. Wds.=*L.* (*Divaricella*) *Cumingi.*
,, *ovum*, Rve.=*Cryptodon globosum.*
Lutraria dissimilis } =*L. rhynchæna.*
,, *oblonga*, ? non Gmelin }
Mactra australis, Lk.=*M. polita.*
Meleagrina albina, Lk.: type attributed to Canal D'Entrecasteaux; considered an error.
Modiola albicostata, var. *polita* } =*M. inconstans.*
et var. *nebulosa*, T. Wds. }
Myochama Woodsi, Petterd } =*M. Tasmanica.*
,, *Woodei* in Paetel }
Myodora elegantula [Angas], Lodder=? *Thraciopsis angustata.*
Mysia spp.=*Diplodonta* spp.
,, *sphericula* [Desh.], Lodder=*D. globularis.*
Mytilicardia cassicosta, Lodder, non Lk.=*Cardita aviculina.*
Mytilus crassus, T. Wds.=*M. ater.*
,, *edulis*, Lodder, non Linn.=*M. planulatus.*
,, *obesus*, Dkr., is wrongly attributed by Paetel.
Nucula Grayi, T. Wds., non D'Orb.=*N. obliqua.*
Ostrea cucullata, Angas, non Born=*O. glomerata.*
,, *edulis*, T. Wds., non Linn.=*O. Angasi.*
,, *mordax*, T. Wds., non Gould=*O. glomerata.*
,, *rutupina*, T. Wds., non Jeff.=*O. Angasi.*
Paphia triquetra [Hanley], Paetel=*Anapella cuneata.*
,, *Novæ-Zelandiæ* is not known in Australia.
Pecten fumatus, T. Wds., non Lk.=*P. meridionalis.*
Pythina Deshayesiana, Lodder, non Hinds=*Mylitta Deshayesi.*

Radula lima, T. Wds.=*Lima multicostata.*

Rupellaria brevis=*Venerupis brevis*, is not Australian.

Saxicava australis, Lk.=*S. arctica.*

Semele decora, A. Ad.: wrongly assigned; doubtfully Australian.

 „ *Warburtoni*, T. Wds., is probably exotic.

Spisula similis, Gray, belongs to N. Australia.

Tellimya anomala, Lodder, apud Angas=*Mysella anomala.*

Teredo navalis [Linn.], T. Wds.: sp. and gen. indeterminate.

Timoclea [=*Chione*] *australis.*

Trigonia acuticostata, non McCoy=*T. margaritacea* (juv.).

 „ *dubia*, Sow.: wrongly assigned to Tasmania (G. B. Sowerby in litt.).

Venerupis attenuata, Reeve, Mon., f. 7: attributed to Tasmania by Paetel; not known.

 „ *brevis*, Q. & G.: wrongly assigned to Australia.

Ventricola gallinula=*Chione gallinula.*

Class PALLIOBRANCHIATA.

Muhlfeldtia [=*Kraussina*] *Atkinsoni.*

 „ [=*Megerlina*] *Lamarckiana.*

Terebratella [=*Terebratulina*] *cancellata*: not yet known.

 „ [*Magasella*] *Cumingi.*

 „ *rubicunda*: not Tasmanian, introduced with oysters (*teste* W. F. Petterd).

V.—CRITICAL REMARKS ON SOME SPECIES AND DIAGNOSES OF TWO NEW SPECIES.

MUREX LAMINATUS, Petterd (*Trophon*).

Spire-whorls four, medially angulated, the anterior half with a keel on the periphery and another half-way to the front suture, crossed by close-set imbricating lamellæ which are raised into scales as they cross the keels. Pullus of one and one-half whorls, smooth, glossy; anterior part of last turn somewhat planulate, then rounded and becoming angulated on the posterior ridge, ending flatly atop—the whole plug-like.

The whole conformation of this evidently very young shell as compared with an equal-sized *M. umbilicatus* suggests near specific affinity.

Dimensions of type: length 5 (vix), breadth 2·75 mm. A few other examples in other collections agree perfectly with the type.

JOSEPHA TASMANICA, Ten.-Woods.

The transference of this species to *Phos* by Dr. Verco has not our approval. *J. Tasmanica* has the characteristic aperture of *Cominella* and the plications on its columella are totally distinct from the twisted and ridged basal part of the columella in *Phos*.

PHOS TENUICOSTATUS, Ten.-Woods (*Cominella*).

This is the living analogue of a distinctive group of species in the genus *Phos*, occurring in the Older Tertiary (chiefly Miocene) of Australia. The group is characterised by its arched columella, twisted and ridged at its front, and by its stout subcylindrical pullus of three or four whorls; the simpler ornamentation, feeble columellar twist, and the form of the protoconch remove these species from the more typical ones, *e.g.*, *P. senticosus*. Among the fossil species, *P. tenuicostatus* comes very near *P. cominelloides*: and among the trivial differences, the most apparent is the slightly shouldered whorls of the fossil.

MITRA LEGRANDI, Ten.-Woods.

The type and two examples referred to the same species identified by the Rev. Ten.-Woods, were given to one of us by Mr Legrand. The first has a length of 4 mm., three spire whorls and a cylindroid pullus of two smooth red-coloured turns; there are four plaits on the columella, the anterior one of which is somewhat immature. South Australian examples have been traced up to a length of 5 mm., with four spire-whorls and four well-defined plaits. The so-called cotypes are those referred to by Ten.-Woods as larger examples of *M. Legrandi*, but they are too large and stumpy to be attached thereto, and they represent the juvenile state of *M. Schomburgki*, most accurately represented by

MARGINELLA JOHNSTONI, Petterd.

This is a micromorph of *M. muscaria*, and exhibits a tumidity on the body-whorl near the outer lip as in that species; though on account of smaller size of the shell it is not so conspicuous. Because Messrs. Pritchard & Gatliff considered this feature to be absent, they have maintained *M. Johnstoni* to be of specific rank. Examples of intermediate size occur on the south coast of Yorke Peninsula, S. Australia.

MITROMORPHA ALBA, Petterd (*Columbella*).

Shell dull white beneath a thin pale straw-coloured epidermis, mitræform, acuminate at both extremities. Embryo of two and one-half smooth convex whorls, of large increase; the tip is of a brown colour. Spire-whorls three and one-half, ornamented by revolving subacute ridges, approximately equal-sized and equidistant, at first five in number, increasing to eight on the penultimate. Body-whorl about three-fourths the total length, ornamented all over with revolving ridges, which are more rounded than those of the earlier whorls. Aperture narrow; columella very slightly arched, with two oblique plications (developed at the adult stage only); outer lip with a wide and shallow sutural sinus, smooth within but its margin minutely crenulated by the spiral liræ. Length 6, breadth 2.25 mm.

The form is that of a *Conomitra*, but having a sutural sinus and the columellar plaits not continued into the interior; it simulates *Mitrella*, differing by the presence of folds on the columella.

In general terms the description of *M. lirata*, Adams (the type), applies to the Tasmanian shell, but as neither figure, dimensions, nor details of ornament are given, it would be unsafe to attach the two; though in *M. lirata* the spire and aperture are stated to be of equal length. The original diagnosis is rather contradictory in respect to the characters of the columella, thus "recta, leviter transversim lirata;" and "like the *Cancilla*-form of *Mitra*, but without any trace of plaits on the columella," and again

[illegible]

The development of [illegible] ridges and of tubercles on the outer lip increases with age, though in the majority of examples the margin of the outer lip is smooth: the denticulation of the lip, an inconstant character, cannot therefore be regarded as sufficient to separate *C. paucirugis* as insisted upon by Pritchard & Gatliff (Proc. Roy. Soc. Vict., xii., 189, 1899).

EULIMA APHELES, Ten.-Woods.

This species is indistinguishable from *E. augur*, except "base marked with three or four equidistant spiral lines."

EULIMA TENISONI.

The type of *E. micans* in the Hobart Museum represents a species distinct from the shell figured by Tryon and attributed by him to Woods' species. It has a shorter spire ending more stoutly, the base flatter though not angulated, aperture relatively larger and slightly more obliquely produced; it has resemblance to *E. fulvescens*, A. Adams.

BATILLARIA DIEMENENSIS, Quoy & Gaimard (*Cerithium*).

A common littoral shell in Southern Australia, commonly recognised as *Turritella cerithium*, Q. & G., accurately agrees with the type specimen in the Paris Museum, though not recognisable from the authors' figure. *Cerithium Diemenense* of the same authors is well figured and agrees with the young shell of the forenamed species. Because *Diemenense* is the earlier name, and because more faithfully pictorally represented, it is here preferentially employed.

TRIFORIS FASCIATA, Ten.-Woods.

This species has been referred to *T. scitula*, A. Adams, imperfectly known; but as that species is stated to have only one series of well-developed granules, whilst *T. fasciata* has three to five, the attachment is not justified.

LITTORINA HISSEYANA, Ten.-Woods.

Many examples of this shell have been received from Mr. Legrand, named as above in the author's own handwriting; they are the fry of *Leiopyrga*, or at any rate belong to *Trochidæ*, as indicated by the pearly lustre and the thin horny multispiral operculum.

LITTORINA EDDIÆ, Petterd, MS.

Found on seaweed at Kelso, Tamar Heads, but not in a living state. is referable to *L. errones*, Nevill, and is presumably an accidental introduction.

FOSSARUS MINUTUS, Petterd (*Crossea*).

Shell minute, turbinate, solid, smooth, shining, dull white. Whorls four, convex; apex bluntly rounded. Peristome entire; outer lip varicosely much thickened, ecurved; basal lip interrupted in the middle by a wide deep notch; columella rounded (broad but not flattened), thickened medially, to simulate a tooth, opposite to the linear umbilical chink. Length 1·1, breadth 0·7 mm.

The unique example cannot satisfactorily be referred to *Crossea*, even though its sinuated front lip were accidentally formed, which it does not appear to be. Its reference to *Fossarus* is doubtful.

ADEORBIS VINCENTIANA, Angas.

The very juvenile state of this species offers some marked characters, unsuspected in adult examples already known up to which they have been traced.

Shell rather patulous, hemispherically depressed, thin, ornamented on the penultimate whorl by elevated lamellæ-like ridges becoming closer and finer with the growth of the shell. Pullus, marked at its junction with the spire by a thick varix, consists of two and one-half translucent whorls, the last of which is roundly angulated and 3- to 4-carinated. Base defined by an angulation commencing at the upper margin of the aperture, which curves round the umbilical crater to join the outer edge of the front lip; the umbilical margin curves round to join the end of the straight columella. Aperture somewhat obliquely trapezoidal; outer lip widely arched; front lip obliquely transverse and straight except at its junction with the columella, where it forms a narrow sulcus. Length and breadth, 2·2 mm.

RISSOIA TUMIDA, Ten.-Woods (*Diala*).

Diala tumida and *Rissoia Kershawi* are certainly the same by comparison of authentically named specimens. The species is closely related to *R. olivacea* and *R. Frauenfeldi;* the ornament is like the latter, but the shell is smaller and not so stumpy and the whorls are flat. Brazier referred *Diala tumida* to *R. olivacea;* but unless *R. olivacea* and *R. Frauenfeldi* are the same, then *R. tumida* is a distinct species. The reference by Brazier of *R. Diemenensis*, Petterd, to *R. olivacea* is confirmed.

RISSOIA DISSIMILIS, Watson (*Eulima*).

The reputed type of *Eulima Tasmanica*, Ten.-Woods, in the Hobart Museum is a *Rissoia*, perhaps a large and white specimen of *R. cyclostoma* as has been suggested; but "its somewhat depressed form," to use the author's phrase, does not apply to *R. cyclostoma*, though it does to *Rissoina cylindracea*, Ten.-Woods, a Port Jackson shell which one of us has recently renamed *Rissoia ischna;* but as suggested by Mr. Hedley, the species is already known as *Eulima dissimilis*, Watson, also a Port Jackson shell. *Eulima eurychades* and *Mucronalia xanthias*, Watson, should be transferred to *Rissoia*. *Eulima Tasmanica* has priority of publication, but the specific name has been virtually preoccupied in *Rissoia; cylindracea* has previously been used, so that Watson's specific name of *dissimilis* should be adopted.

R. dissimilis, *R. Verconis* and *R. Simsoni* are closely related; *R. Verconis* is much smaller than *R. dissimilis*, is margined at the anterior suture, which is deeply channelled; *R. Simsoni* is more cylindroid and is much larger than *R. dissimilis*.

RISSOIA MARIÆ, Ten.-Woods.

This species has been somewhat generally but erroneously attributed to *Diala semistriata*, to which it has some resemblance; but is more elongated, with convex whorls, has a complete peristome, and the base is smooth (not striated as is usual with *D. semistriata*). *R. Mariæ* is not infrequently of a uniform dark colour. It occurs in S. Australia (R. Tate) and in Victoria (J. H. Gatliff !).

RISSOPSIS spp.—We have referred to this genus three *Rissoia*-like species which offer two well-defined differential characters, namely, an included nucleus (the summit of the spire is truncated and the nuclear whorls are immersed) and a thin exserted columellar lip; in shape they are inclined to be cylindroid. The reference to *Rissopsis* is conjectural, as no authenticated example of it has been studied by us.

LIOTIA ANNULATA AND L. COMPACTA.

These are distinct species; the former has a sunken spire and the interspaces between the ribs are smooth; the latter has a flat spire and is spirally striated between the ribs; otherwise they are much alike.

CANTHARIDUS ALLPORTI, Ten.-Woods (*Zizyphinus*).

Living examples are of a shining pale brown colour, sparsely rose-spotted; the liræ within the aperture correspond in number with the exterior revolving ridges. In old specimens the anterior suture is margined by a bifid non-granulose encircling rib.

CANTHARIDUS BAUDINI, Fischer (*Trochus*).

The so-called *Zizyphinus fragum* of previous Tasmanian lists is referred to the above. The most conspicuous difference between *Z. fragum*, Phil., and *C. Baudini* is in the number of granular ribs: for the former four (apud Philippi), for the latter eight (apud Fischer), increasing to eleven.

AKERA TASMANICA, Beddome.

Shell globosely-oblong, imperforate, thin, hyaline. Colour brown, darker-tinted posteriorly, with a narrow white band near the shoulder and a wider one in the anterior-third. Last whorl inflated, equalling the total length of the shell, rounded at the shoulder; spire truncated, flush with the posterior margin of the last whorl, separated by a channelled suture, terminated by a hyaline bulbous nucleus. Aperture contracted above, enlarging anteriorly to the arched front; outer lip truncatedly angled posteriorly; columella arched, simple. Length 1·9, width 1·2 mm.

Description based on an authentic specimen in the collection of Mr. W. F. Petterd.

MYOCHAMA TASMANICA, Ten.-Woods (*Gouldia*).

Gouldia Tasmanica, as illustrated by the accompanying figures of the type (Text fig. 13), is clearly a *Myochama*, as already indicated by Mr. Petterd; its inner aspect shows the triangular ligamental pit and the absence of teeth; it represents the free stage of the species, which is characterised by its widely separated rounded concentric ridges. Length 2·5, width 3 mm.

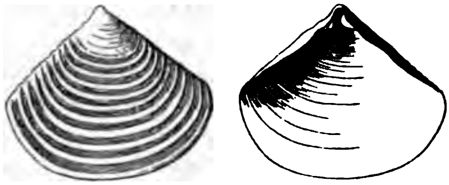

Fig. 13.—*Myochama Tasmanica.*

M. Woodsii, Petterd, is founded on the same species after becoming attached and extending irregularly. Length and width, 10 mm.

MERETRIX PLANATELLA, Lamarck.

Philippi in 1845 was the first to figure this Lamarckian shell and to give it a locality, "Insula Van Diemenensis"; the figure represents a young shell of about 20 mm. in the anterior-posterior diameter. Tenison-Woods misread Philippi's locality as "Terra Van Diemenensis," and so included the species as Tasmanian. E. A. Smith in the Challenger Report (p. 136), makes *M. Diemenensis* a synonym with *M. planatella. Venus nitida*, Quoy & Gaimard, if the type locality (Hobart) is correct, is probably synonymic; otherwise it is not known here. The species attains to a length of 65 mm.

VENERUPIS BREVIS, Quoy & Gaimard.

The type-example of this species is reputed to have come from Hobart. Hutton (Man. N. Zealand Shells, 1880, p. 152) says of *V. brevis* that it is probably the same as *V. paupercula*, which Carpenter records from Mazatlan.

V. brevis from its figure recalls *V. obesa*, the margin of which is not crenulated. Indeed, it would appear as if a mistake had been made; the crenulated margin belongs to *V. Diemenensis*, as indicated by its radial costation. However, *V. brevis* is not known to Tasmanian collectors, but if Tasmanian it may be a deformed example of *V. obesa.*

MYTILICARDIA AVICULINA, Lamarck.

The type came from King Island and was figured by Delessert in 1841, and the study of that figure does not permit of hesitation in regarding *excavata* and *Tasmanica* as the same as it. *M. excavata* is based on a young shell, having rose-coloured spots chiefly on the large post-medial ribs. *M. Tasmanica* is based also on a small-sized specimen; "gaping below" is incorrect, and the distinction "ribs smooth instead of lamellar projecting scales" is also incorrect; *M. Tasmanica* is perhaps more dilated behind, and *M. excavata* shows a tendency of the larger ribs to become broader as compared with *M. Tasmanica;* but these differences are individual rather than racial.

MODIOLARCA TASMANICA, Beddome.

If Miss Lodder's specimen, which is figured on p. 439, is rightly named and there is no reason for doubt, then the species is an interesting addition to a genus known hitherto by three species, all of the Southern Hemisphere, two of which are circumpolar. *M. Tasmanica* is most allied to *M. trapezina*, Lamarck, from which it differs by the insinuation of the antero ventral margin, by the attenuated and prolonged front margin, and by the possession of two teeth on the hinge-line (E. A. Smith describes the hinge of *M. trapezina* "with a small tubercular tooth in each valve").

PECTEN ACTINOS, Petterd.*

This species has the form and general ornament of *P. tigris*, as represented by Philippi's figures of that Lamarckian shell. The radial groups are about twelve, flatly convex and truncatedly defined; the costal threads in each group are usually three, and there are one to three threads in the concave interspaces. The sculpture, all over, consists of quincunxially arranged, small, close-set pits as in *P. undulatus*.

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* To this species I should refer *P. bednalli*, Tate; but as my late colleague was not consulted on this point the synonym is not inserted in the text.—

CARDITELLA ELEGANTULA, sp.nov. (Text fig.14.)

Shell rotund, slightly oblique, solid, white; regularly and closely concentrically lamellose-striate, crossed by about 20 shallow radial sulci which undulate the concentric raised threads. Inner margin of valves strongly crenate-dentate.

Length and width 4 mm.

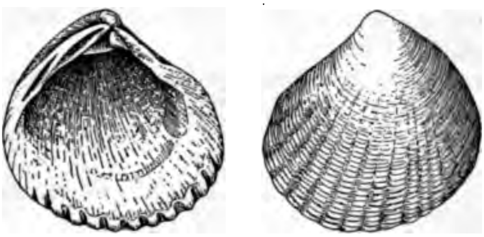

Fig. 14.—*Carditella elegantula.*

Comes nearest to *C. infans*, which is distinctly costated and traversed by transverse depressed ridges.

Blackman's Bay, *W. F. Petterd.*

Genus LEGRANDINA, Tate & May.

Shell equivalve, nearly equilateral, oval; hinge-line curved, furnished in the right valve with a prominent cardinal tooth, in the left with two diverging cardinals; several oblique lateral teeth in each valve. Cartilage internal in a pit under the beak.

Genus proposed for a minute bivalve obtained some years ago from the stomach of a mullet (probably taken in the Derwent) by Mr. W. Legrand, the veteran Tasmanian conchologist. There appears to be no existing genus that can properly receive this form; its nearest relative seems to be *Perrierina*, Bernard, from Stewart Island. It is perhaps the most minute Australian pelecypod yet described, and its characters are descernible with difficulty.

L. BERNARDI (Pl. xxvii., figs. 98, 99):

Shell minute, equivalve, nearly equilateral; thin, white, shining and semitransparent, moderately convex; surface ornamented with numerous fine radial ridges, most conspicuous towards the ventral margin, crossed by close thread-like striæ or growth-lines, margin scarcely crenulated. Hinge-line curved; in the right valve are a long subcostal cardinal tooth and two anterior sloping teeth; on the posterior side are three strong oblique lateral teeth. Left valve with two diverging flattened cardinal teeth, and laterals corresponding to those in the right valve. Cartilage internal, in a pit beneath the beaks. Muscular scars very faint; pallial line simple. Umbo, ventral diam. 1·5, antero-posterior diam. 1·7 mm.

Type to be presented to the Hobart Museum; a considerable number of specimens collected.

EXPLANATION OF PLATES.

Plate xxiii.

Fig. 1.—*Crossea cancellata*, Ten.-Woods; from a specimen in Petterd's Collection.
Fig. 2.—*Lampusia nodocostata*, Tate & May; from the type.
Fig. 3.—*Murex laminata*, Petterd; from the type.
Fig. 4. *Odontostomia Tasmanica*, Ten.-Woods; from a specimen in the Hobart Museum.
Fig. 5.—*Rissoa perexigua*, Tate & May; from the type.
Fig. 6.—*Erato bimaculata*, Tate.
Fig. 7.—*Alexia meridionalis*, Brazier.
Fig. 8.- *Rissoa pellucida*, Tate & May; from the type.
Fig. 9.—*Fossarina funiculata*, Ten.-Woods.
Figs. 10-11.—*Triforis fasciatus*, Ten.-Woods.
Fig. 12.—*Clanculus philomena*, Ten.-Woods; from the type.
Fig. 13.—*Apollo epitrema*, Ten.-Woods; from the type.
Fig. 14. - *Thylacodes caperatus*, Tate & May; from the type.
Figs. 15-17.—*Turritella Atkinsoni*, Tate & May.

Plate xxiv.

Fig. 18.—*Rissoa demessa*, Tate & May; from the type.
Fig. 19.—*Columbella saccharata*, Reeve.
Fig. 20.—*Cantharus kingicola*, Tate & May; from the type.
Figs. 21-22.—*Gibbula Legrandi*, Petterd.
Fig. 23.—*Schismope Tasmanica*, Petterd; from the type.
Fig. 24.———— *Beddomei*, Petterd; from the type.
Fig. 25-26.—*Zidora Legrandi*, Tate; from Tate's specimen.

Fig. 27.—*Drillia cancellata*, Beddome; from a specimen compared with Beddome's type.

Fig. 28.—*Daphnella minuta*, Ten.-Woods; from a specimen in the Hobart Museum.

Fig. 29.—*Drillia Agnewi*, Ten.-Woods; from the type.

Fig. 30.—*Mitra Franciscana*, Ten.-Woods; from a specimen dredged in the Derwent.

Fig. 31.—*Gibbula dolorosa*, Ten.-Woods; from the type.

Fig. 32. *Clathurella Desalesii*, Ten.-Woods.

Fig. 33.———— *St.-Galliae*, Ten.-Woods; from a specimen in collection of Rev. H. D. Atkinson.

Fig. 34.———— *granulosissima*, Ten.-Woods.

Fig. 35.—*Mangilia delicatula*, Ten.-Woods.

Fig. 36.—*Donovania fenestrata*, Tate & May; from the type.

Plate xxv.

Fig. 37.—*Syrnola Petterdi*, Tate & May; from the type of *Obeliscus tasmanicus*, Petterd.

Fig. 38.—*Eulimella turrita*, Petterd; from the type.

Figs. 39-40.—*Liotia subquadrata*, Ten.-Woods.

Fig. 41.—*Scalaria minutula*, Tate & May.

Fig. 42.—*Ancilla Petterdi*, Tate.

Figs. 43-44.—*Eulimella micra*, Petterd; from the type.

Fig. 45,—*Odontostomia deplexa*, Tate & May; from the type.

Figs. 46-48.—*Cyclostrema Harriettæ*, Petterd.

Fig. 49.—*Natica Tasmanica*, Ten.-Woods.

Fig. 50.—*Eulima Mayi*, Tate; from the type.

Fig. 51.—*Dentalium Weldianum*, Ten.-Woods; from a specimen in the Hobart Museum.

Fig. 52.—*Cadulus spretus*, Tate & May; from the type.

Fig. 53.—*Odontostomia varians*, Tate & May; from the type.

Fig. 54.—*Syrnola micra*, Pritchard & Gatliff; from the type of *S. Harrissoni*, Tate & May.

Figs. 55-56.—*Pseudorissoina Tasmanica*, Ten.-Woods.

Fig. 57.—*Eulimella aurantica*, Angas; from the type of *E. aurantia*, Petterd.

Fig. 58.—*Eulima inflata*, Tate & May; from the type.

Fig. 59.—*Liotia densilineata*, Tate; from a cotype.

Fig. 60.—*Eulima Tenisoni*, Tyron; from the type of *Eulima micans*, Ten.-Woods.

Plate xxvi.

Fig 61.—*Rissoa apicilirata*, Tate & May; from the type.

Fig. 62. ——— *Hulliana*, Tate.

Fig. 63. ——— *bicolor*, Petterd.

Fig. 64. *Rissoa Beddomei*, Tate.
Fig. 65. ——— *descrepans*, Tate & May; from the type.
Fig. 66.—*Fossarus bulimoides*, Ten.-Woods; from the type (?) in Hobart Museum.
Fig. 67.—*Rissoa tumida*, Ten.-Woods.
Fig. 68.—*Odontostomia varians*, Tate & May.
Fig. 69.—*Rissoa approxima*, Petterd; from the type.
Fig. 70. ——— *Agnewi*, Ten.-Woods.
Fig. 71. ——— *dubitabilis*, Tate; from type of *R. dubius*, Petterd.
Fig. 72. ——— *demessa*, Tate & May; from the type.
Fig. 73. ——— *Petterdi*, Brazier; from the type of *R. pulchella*, Petterd.
Fig. 74.—*Marginella cratericula*, Tate & May; from the type.
Fig. 75.—*Rissopsis bulimoides*, Tate & May; from the type.
Fig. 76.—*Rissoa Simsoni*, Tate & May; from the type.
Fig. 77. ——— *unilirata*, Ten.-Woods.
Fig. 78.—*Marginella denticulata*, Tate; from Tate's specimen.
Fig. 79.——— *pumilio*, Tate & May; from the type of *M. minutissima*, Ten.-Woods.
Fig 80.——— *Allporti*, Ten.-Woods.
Fig. 81.——— *tridentata*, Tate.
Fig. 82.——— *Stanislaus*, Ten.-Woods; banded form.
Fig. 83.——— *cymbalum*, Tate; from Tate's specimen.

Plate xxvii.

Fig 84.—*Marginella Mayi*, Tate; from the type.
Fig. 85.—*Crossea minuta*, Petterd; from the type.
Fig. 86.—*Rissoa Verconis*, Tate; from the type.
Fig. 87.—*Marginella biplicata*, Tate & May; from the type.
Fig. 88.——— *multiplicata*, Tate & May; from the type.
Figs. 89-90.—*Nacella Tasmanica*, Pilsbry; from a cotype.
Fig. 91.—*Cyclostrema micron*, Ten.-Woods.
Fig 92.—*Marginella ovuleformis*, Tate & May; from the type.
Fig. 93.—*Cyclostrema porcellanum*, Tate & May; from the type.
Fig. 94.—*Rissopsis consorbrina*, Tate & May; from the type.
Fig. 95.—*Marginella Simsoni*, Tate & May; from the type of *Marginella minima*, Petterd.
Figs. 96-97.—*Carditella pectinata*, Tate & May; from the type.
Figs. 98-99.—*Legrandina Bernardi*, Tate & May; from the type.
Figs. 100-101.—*Carditella delta*, Tate & May; from the type.
Fig. 102.—*Diplodonta Tasmanica*, Ten.-Woods.
Fig. 103.—*Cyamium mactroides*, Tate & May; from the type.
Figs. 104-106.—*Myodora Tasmanica*, Ten.-Woods.
Fig. 107.- *Carditella Atkinsoni*, Ten.-Woods; from a specimen in collection

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(Names in italics are Synonyms.)

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NOTES AND EXHIBITS.

Mr. A. A. Hamilton exhibited specimens of some interesting plants from new localities as follows:—

Hibbertia serpyllifolia, R.Br.—Cook's River (A. A. Hamilton; November, 1900). Specimens in the National Herbarium are from the Blue Mountains (Mr. J. H, Maiden); and Mr. Camfield has collected specimens at Loftus, National Park. The "Handbook of the Flora of N.S.W." records the species from the Blue Mountains, and Southern Coast District.

Melaleuca Deanei, F.v.M.—Cook's River (A. A. Hamilton). Locality given in the "Handbook of the Flora" is Lane Cove River. Mr. Deane informs me that the type specimens (described by Baron von Mueller, Proc. Linn. Soc. N.S.W., 1886) were taken from isolated plants. Mr. Camfield has also collected specimens from individual plants between Arncliffe and the National Park. In view of the possible extinction of this rare plant I would suggest its cultivation. I may mention that the seeds do not mature until the second or third season.

Cyperus platystylis, R.Br.—Manly (A. A. Hamilton). Recorded in Woolls' "Plants Indigenous in the Neighbourhood of Sydney;" only one locality is given elsewhere, viz., Hawkesbury River.

Sporobulus diander, Palis.—Cook's River (A. A. Hamilton; Dec., 1900). The localities given for this grass are with one exception from the Blue Mountains, north through Queensland. Mr. Fred Turner in his work "Australian Grasses" gives the locality and range as coastal districts of New South Wales and Queensland. Specimens in the National Herbarium are from the Blue Mountains and the interior; also from Homebush (Coll. J. H. Maiden).

Lindsaya trichomanoides, Dryand.—Bulli (M. T. Perry; May, 1900). In the Proceedings of this Society for 1886 (p. 929) will be found a Note on this species by the Rev. Dr. Woolls confirming an earlier doubtful record in the "Flora Australiensis" of its occurrence at the Kurrajong.* The "Handbook of the Flora" gives the locality as Clyde River district. Specimens in the National Herbarium are from the Pacific Islands and New Zealand. The specimens under notice are identical with the last mentioned.

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* Some of Mr. Selkirk's specimens from the Kurrajong, with fructification, were exhibited by Dr. Woolls in illustration of his Note, and were afterwards presented by him to the Society's herbarium—[Ed.].

[Printed off December 12th, 1901.]

Rev. W. Walter Watts contributed the following

Additional Notes on the Mosses of New South Wales.

Having received a further report from Dr. V. F. Brotherus upon specimens of Mosses sent to him at intervals, I beg to communicate, for purposes of record, a few notes upon the returns.

(i). My Richmond River collections have yielded the following results :—

1. Seven new species, including a genus new for New South Wales, which will be recorded when described, and a new form (*f. flagellaris*, Broth.) of *Acanthocladium extenuatum*, Brid.

2. Three species and one form new for New South Wales, viz.:

Archidium brisbanicum, C. Muell.
Bryum immarginatum, Broth.
Physcomitrium brisbanicum, C. Muell.
} Previous record Queensland.

Bryum erythropyxis, C.M. *f. minor.*—Previous record unknown to me.

3. Eight species and one variety new for the Richmond River, viz. :

Bryum abruptinervium, C. Muell.—Previously recorded from Mosman's Bay by Mr. Whitelegge.

Bryum argenteum, var. *niveum.*—Previously found at Tamworth by Mr. C. T. Musson; also in Tasmania by Mr. Weymouth.

Bryum crenatidens, C. Muell.—Previously found at Cambewarra by Mr. Whitelegge.

Bryum erythropyxis, C. Muell. — Previously recorded from Hume River by Miss Campbell; from Cambewarra by Mr. Whitelegge; and from Appin and National Park by Mr. Forsyth; also found at Tamworth last year by Mr. D. A. Porter.

Bryum pyrothecium, Hpe., C.M.—Previously recorded from Cambewarra by Messrs. Whitelegge and Thorpe; and from King's Tableland, National Park and the Nepean River by Mr. W. Forsyth.

Leucobryum candidum, Brid.—Previously found at Braidwood by Mr. W. Bäuerlen; and at Lilyvale by Mr. Whitelegge. Well known in New Zealand and Tasmania.

Anomodon brevinervis, Broth.—Previously found at Cambewarra by Mr. Whitelegge; and in Queensland by Mr. Wild.

Porotrichum gracillimum (Hampe), Broth.—Previously found at Gosford by Mr. Whitelegge.

Rhizogonium Geheebii, C. Muell.—Previously collected at Gosford by Mr. Whitelegge; and "near Sydney" by Mrs. Kayser.

(ii.) A collection made at Emu Plains and on the banks of the Nepean gave the following results :—

1. Two new species.

2. Fifteen species, and two forms, either new for N.S.W., or new for the Nepean district.

Acaulon Sullivani, C.M.

Entosthodon Smithhurstii, Broth., Geh.

Bartramia strictifolia, Tayl.—This species, new for N.S.W., has also been collected at the Warrumbungle Ranges by Mr. Forsyth.

Ephemerum cristatum, C. Muell.

Fissidens ligulatus, H.f.W.

Fissidens Woollsianus, C.M.

Grimmia apocarpa (L), Hedw.: f. foliis brevissime piliferis vel. submuticis.

Fissidens Dietrichiae, C.M.: f. minor.

Hypnum rutabulum.

Stereodon cupressiformis (L).

Tortula atrovirens, (Sm.)

,, *chlorotricha*, Broth., Geh.

Leptodontium papillatum (H.f.W.).

Orthodontium lineare, Tayl.

Pleuridium brachycaulon (C.M.).

Pleuridium viride (C.M.)

Porotrichum gracillimum (Hpe.), Broth.

(iii.) Specimens collected at Mosman's Bay, Waverley and Burwood, yielded the following results :—

1. One new species found on a fruit tree in the Hon. E. Vickery's garden, Waverley.

2. The following species of interest:

Tortula panduræfolia, Hpe., C.M.—At Waverley and at Mosman's Bay.

Pleuridium brachycaulon (C.M.).—Burwood and Concord.

Pleuridium nervosum (Hook.).—Burwood; previously recorded from Parramatta by Mr. Whitelegge.

Macromitrium Geheebii, C. Muell.—At Mosman's Bay mixed with *Macromitrium Wattsii*, *Tortula panduræfolia*, and *Raphidostegium aciculum*, C.M. This curious Macromitrium was found by Mrs. Kayser "near Sydney" in 1872. The present is the second record. But I understand that, by an interesting coincidence, it has been found by Mr. Maiden at Stuartbrook.

(iv.) I beg also to note that one of my specimens from Emu Plains was a *Pottia*, a genus not yet recorded for New South Wales, but that the species was not determinable. I have also to add that Mrs. King, of Waverley, sent me a small collection of mosses from the Blue Mountains, and that among them was *Brentelia fusco-aurea*, Broth., a new species recorded lately by Mr. W. Forsyth. I may also report the following finds:

Hedwigia ciliata (Dicks.).—Tarana (Mr. J. A. Thorpe).

Grimmia leiocarpa, Tayl.—Girilambone (Mr. Bäuerlen).

Funaria hygrometrica, L.—Girilambone (Mr. Bäuerlen).

Campylopus clavatus, R.Br.—Grose Valley (Mr. Bäuerlen).

An omission has also to be supplied. Dr. Brotherus' paper—"Some New Species of Australian Mosses," Part ii.—contains a description of *Macromitrium exsertum*, Broth., found by Mr.

W. Bäuerlen in the south of this State. The species has not hitherto been referred to in this Society's Proceedings.

Mr. Johnston exhibited mounted specimens and sections in illustration of his paper.

Mr. R. Helms exhibited a remarkable spider (*Dicrostichus* sp.) from Rose Bay, together with its nest and egg-bags.

The President exhibited several botanical relics of very great historical interest to Australian botanists, namely, a specimen of *Eucalyptus robusta*, Sm., collected and labelled by Robert Brown "Swamp Mahogany, Septr. 1803, near the sleeping-place, Sydney"; a sample of the drying paper used by the same botanist in 1802, with a number of notes thereon in his own handwriting, showing the patient care exercised in drying his specimens; and a specimen of *Embothrium* [*Lomatia*] *tinctorium* collected in Tasmania in 1801 by Labillardière, whose herbarium was subsequently acquired by Mr. Webb, of Florence, and afterwards presented to the Botanical Institute of the same city.

WEDNESDAY, AUGUST 28TH, 1901.

The Ordinary Monthly Meeting of the Society was held in the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, August 28th, 1901.

Mr. J. H. Maiden, F.L.S., &c., President, in the Chair.

DONATIONS.

Department of Agriculture, Brisbane—Queensland Agricultural Journal. Vol. ix. Part 2 (August, 1901). *From the Hon. the Secretary for Agriculture.*

Department of Mines and Agriculture, Sydney—Agricultural Gazette of New South Wales. Vol. xii. Part 8 (August, 1901). Memoirs of the Geological Survey of New South Wales, Sydney —Geology, No. 2. The Iron Ore Deposits of New South Wales. By J. B. Jaquet, F.G.S. (1901). *From the Hon. the Minister for Mines and Agriculture.*

Royal Society of New South Wales, Sydney—Abstract of Proceedings, August 7th, 1901: Journal. Vol. xxxiv. (1900). *From the Society.*

Department of Mines and Water Supply of Victoria—Annual Report for the Year 1900. *From the Secretary for Mines and Water Supply.*

Field Naturalists' Club of Victoria, Melbourne—Victorian Naturalist. Vol. xviii. No. 4 (August, 1901). *From the Club.*

Royal Society of Victoria, Melbourne—Proceedings. Vol. xiv. (New Series). Part 1 (August, 1901). *From the Society.*

University of Melbourne—Matriculation Examination Papers, May, 1901. *From the University.*

Department of Agriculture, Perth, W.A.—Journal. Vol. iv. Part 1 (July, 1901). *From the Secretary.*

Conchological Society of Great Britain and Ireland, Manchester—Journal of Conchology. Vol. x. No. 3 (July, 1901). *From the Society.*

Entomological Society of London—Transactions, 1901. Part 2 (July, 1901). *From the Society.*

Geological Society, London—Geological Literature added to the Geological Society's Library during the Year ended December 31st, 1900 (June, 1901). *From the Society.*

Manchester Literary and Philosophical Society—Memoirs and Proceedings. Vol. xlv. Part 3 (July, 1901). *From the Society.*

Royal Physical Society, Edinburgh—Proceedings. Vol. xiv. Part 3 (Session 1899-1900). *From the Society.*

Royal Society of London—Proceedings. Vol. lxviii. No. 447 (July, 1901). *From the Society.*

Royal Irish Academy, Dublin—Transactions. Vol. xxxi. Parts 8-11 (June-July, 1900). *From the Academy.*

Perak Government Gazette, Taiping. Vol. xiv. Nos. 21-23 (June-July, 1901). *From the Government Secretary.*

American Academy of Arts and Sciences, Boston—Proceedings, Vol. xxxvi. Nos. 16-23 (January-March, 1901). *From the Academy.*

Academy of Natural Sciences, Philadelphia—Proceedings, 1900. Part 3 (September-December). *From the Academy.*

American Geographical Society, New York—Bulletin. Vol. xxxiii. No. 3 (1901). *From the Society.*

American Museum of Natural History, New York—Bulletin. Vol. xiii. (1900); Vol. xiv. Articles i.-iv., pp. 1-52 (January-February, 1901): Memoirs. Vol. iv. (Anthropology, Vol. iii.). Part 2 (January, 1901). *From the Museum.*

American Naturalist, Cambridge. Vol. xxxv. No. 414 (June, 1901). *From the Editor.*

Brooklyn Institute of Arts and Sciences—Science Bulletin. Vol. i. No. 1 (April, 1901). *From the Institute.*

California Academy of Sciences, San Francisco—Occasional Papers. No. vii. Synopsis of California Stalk-eyed Crustacea. By S. J. Holmes (June, 1900): Proceedings. Third Series. *Botany.* Vol. i. No. 10; Vol. ii. Nos. 1-2 (1900): *Geology.* Vol. i. Nos. 7-9 (1900): *Math.-Physics.* Vol. i. Nos. 5-7. (1899-1900): *Zoology.* Vol. i. T.p., &c. (1897-1899); Vol. ii. Nos. 1-6 (1899-1900). *From the Academy.*

Field Columbian Museum, Chicago—Anthropological Series. Vol. ii. No. 4 (December, 1900): Geological Series. Vol. i. No. 8 (February, 1901): Report Series. Vol. i. No. 6 (October, 1900): Zoological Series. T.p., &c., of Vol. i. (1895-1899); Vol ii. (1901); Vol. iii. No. 3 (March, 1901). *From the Museum.*

Johns Hopkins University, Baltimore—Hospital Bulletin. Vol. xi. Nos. 108-114, 116-117 (March-December, 1900): University Circulars. Vol. xix. Nos. 144-147 (April-July, 1900): *Ophiura brevispina*, a Dissertation. By C. Grave (4to. 1900). *From the University.*

Museum of Comparative Zoology, Harvard College, Cambridge—Bulletin. Vol. xxxvi. No. 7 (July, 1901). *From the Director.*

Bureau of American Ethnology, Washington—Seventeenth Annual Report (1895-96). Part 1: Eighteenth Annual Report (1896-97). Part 1. *From the Director.*

U.S. National Museum, Washington—Reports for the Years ending June 30th, 1897 (Part ii.), 1898, and 1899 (1900-1901): Report upon the Condition and Progress of the U.S. National Museum during the Years ending June 30th, 1898 and 1899 (1900-1901). *From the Director.*

Washington Academy of Sciences — Proceedings. Vol. iii. pp. 217-272 (July, 1901). *From the Academy.*

Wisconsin Natural History Society, Milwaukee—Bulletin. New Series. Vol. i. No. 4 (October, 1900). *From the Society.*

Government Museum, Madras—Catalogue of the Prehistoric Antiquities. By R. B. Foote, F.G.S. (1901). *From the Museum.*

Gesellschaft für Erdkunde zu Berlin—Verhandlungen. Band xxvii. (1900). Nos. 9-10; Band xxviii. (1901). Nos. 1-2: Zeitschrift. Band xxxv. (1900). Nos. 4-5. *From the Society.*

Naturhistorisches Museum in Hamburg—Mitteilungen. xvii. Jahrgang (1900). *From the Society.*

Naturwissenschaftlicher Verein des Regierungsbezirkes zu Frankfurt a.d. Oder—Helios. Band xviii. (1901): Societatum Litteræ. Jahrgang xiv. Nos. 1-12 (1900). *From the Society.*

Zoologischer Anzeiger, Leipzig. xxiv. Band. No. 647 (Juli, 1901). *From the Editor.*

Société Royale Linnéenne de Bruxelles—Bulletin. 26e Année. Nos. 7-8 (Juin-Juillet, 1900). *From the Society.*

Journal de Conchyliologie, Paris. Vol. xlix. No. 2 (1901). *From the Director.*

Société Hollandaise des Sciences à Harlem—Archives Néerlandaises. Série ii. Tome iv. 3e Liv. (1901). *From the Society.*

Académie Impériale des Sciences de St. Pétersbourg—Bulletin. ve. Série. Tome xii. Nos. 2-5 (1900); Tome xiii. Nos. 1-3 (1900): Mémoires. viiie. Série. Tome x. No. 7 (1900). *From the Academy.*

Zoologische Station zu Neapel—Mittheilungen. xiv. Band. 3 u. 4 Heft (1901). *From the Society.*

Konink. Natuurk. Vereeniging in Nederl. Indië, Batavia—Natuurkundig Tijdschrift. Deel lx. (1901). *From the Society.*

DESCRIPTIONS OF NEW SPECIES OF AUSTRALIAN COLEOPTERA.

By Arthur M. Lea.

Part VI.

MALACODERMIDÆ.

Carphurus rhytideres, n.sp.

♂. Elongate, shining, depressed. Red; head at base, eight apical joints of antennæ, a transverse patch at apex of prothorax, scutellum, meso- and metasternum, abdomen (except apical segment, apical half of penultimate and apex and sides of the other segments), coxæ and femora (except knees) black; tarsi infuscate or not; elytra coppery-green or blue. Clothed with long straggling blackish hair and with fine whitish pubescence, more noticeable on elytra and abdomen than elsewhere.

Head with fine punctures at base and sides; a distinct fovea on each side in front and a less distinct one behind and between them. Antennæ rather stout, scarcely extending to apex of elytra, 3rd-10th joints feebly serrate internally. *Prothorax* transverse, sides round; in front with a deep transverse polished groove; median line very distinct from near base to near apex, polished and traceable across frontal groove; each side with a deep oblique groove starting from the posterior angles and opening out into the frontal groove. *Scutellum* subquadrate, sides and apex slightly incurved. *Elytra* slightly increasing in width to apex, densely and rugosely punctate. *Abdomen* almost impunctate. *Legs* long; anterior tibiæ distinctly bisinuate beneath, the others straight. Length 7⅓, to apex of elytra 4½; width 1⅔ mm.

♀. Differs in having the head smaller, with thinner antennæ, the prothorax simple (except for a feeble longitudinal impression), less transverse and with the black patch less transverse and more rounded.

Hab.—Geraldton, W.A. (on spinifex grass and on several species of *Acacia*).

The sculpture of the prothorax in the male is most remarkable; the three deep grooves (leaving out of consideration the median line) are rather wide and deep, the transverse one deeper than the others, and (intensified by its colour) appearing as if seared in with a red-hot wire; on each side of each of the oblique grooves there is a small (almost fasciculate) tuft of black hair. The female is a typical *Carphurus*, so I have not considered it necessary to generically separate the species.

CARPHURUS INVENUSTUS, n.sp.

♂. Elongate, shining, depressed. Head and prothorax of a rather dark red, the former at base clouded with black; antennæ black, the three basal joints red; elytra purplish-black; abdomen black; legs black, the anterior tibiæ and knees and the four posterior tibiæ at extreme base red. Clothed with long blackish hair, sparse on head but denser there than elsewhere, the elytra and abdomen with fine and rather sparse whitish pubescence.

Head narrowed behind eyes, these rather large and prominent; finely and irregularly punctate, a shallow fovea between and slightly in front of eyes. Antennæ not extending to apex of elytra, 4th-10th joints rather strongly serrate internally. *Prothorax* longer than wide, sides slightly rounded, apex rounded; transversely depressed at base; impunctate. *Scutellum* almost concealed but evidently reddish. *Elytra* increasing in width to apex; densely and rather finely punctate, base very finely punctate, apex impunctate and polished. *Abdomen* impunctate. *Legs* long and thin. Length 5, to apex of elytra 3¾; width 1½ mm.

♀. Differs in having considerably smaller and less prominent eyes, shorter antennæ, and the prothorax less depressed at base and clouded with black on the sides anteriorly.

Hab.—Nowra, N.S.W. (Mr. G. Masters).

A dingy species not very close to any with which I am acquainted.

C. CYANOPTERUS, Bohem. *Hab.*—Mount Barker, W.A.

C. LATIPENNIS, Lea. *Hab.*—Swan River, W.A.

NEOCARPHURUS BASIZONIS, n.sp.

Narrow, shining. Deep glossy black; lower part of head, knees, tarsi and basal segments of abdomen obscure brown; antennæ pale yellow, the four apical joints black; basal two-sevenths of elytra pale testaceous, the extreme base, suture and about scutellum infuscate; base of prothorax testaceous; eyes dingy-green, when wet a beautiful emerald-green. The entire upper surface with long thinly scattered blackish hairs.

Head feebly transverse, almost flat, with a feeble impressed line on forehead; finely punctate; antennæ as in *N. chlorops*. *Prothorax* impunctate, longer than wide, basal third depressed and suddenly and greatly narrowed, slightly increasing in width from basal third to extreme base. *Scutellum* very small. *Elytra* widely emarginate at base, sides slightly increasing in width to apex, about once and one-half the length of prothorax, impunctate. *Abdomen* impunctate, widest in middle. *Legs* long and thin; posterior tibiæ feebly curved. Length 2¾, to apex of elytra 1½; width ⅔ mm.

Hab.—Nowra, N.S.W. (Mr. G. Masters).

The specimen described (judging by its smooth head) appears to be a female, but I have described it as it represents a very distinct species. Mr. Masters obtained two specimens, one of which he kindly presented to me.

BALANOPHORUS MEGALOPS, n.sp.

♂. Elongate, shining, depressed. Black, the elytra with a bluish or purplish gloss; two basal joints of funicle and under surface of 3rd, mouth-parts and extreme base of head, prothorax, basal fifth of elytra, mesosternum, abdomen (except two apical segments), four anterior coxæ, basal half of anterior femora and extreme base of anterior tibiæ clear reddish-testaceous. Sparsely clothed with long blackish hair, the elytra and legs in addition with fine greyish pubescence.

Head considerably wider than prothorax and almost the width of apex of elytra; eyes very large and prominent, occupying more than half the total width; behind eyes very finely transversely corrugated. Antennæ extending to apex of elytra; 3rd-10th joints pectinate, ramus of 3rd short, of 4th as long as the joint itself, of each of 5th-10th twice as long as the joint, these slightly curved, 11th joint very distinctly curved, its apex slightly thickened and acuminate. *Prothorax* almost twice as wide as long, gently convex, sides very gently rounded. *Elytra* at base about once and one-half the width of prothorax, at apex fully twice as wide; apex conjointly rounded; moderately distinctly punctate. Basal joint of *tarsi* as long or almost as long as the rest combined; comb of anterior indistinct. Length to apex of elytra 3½, of abdomen 4½; width 1⅓ mm.

Hab.—Otford, N.S.W. (type in Coll. Mr. George Masters).

A small and very pretty species about the size of *B. biplagiatus* or *janthinipennis*, but very different from either; in its large eyes it resembles *B. Macleayi*.

CLERIDÆ.

LEMIDIA OBLIQUEFASCIATA, Gorham.

Not having sufficient literature at present I cannot enter into the synonymy of this species. But as it is an abundant one about the Swan River, and has numerous varieties, some notes may be of use. The species may be beaten abundantly from the blossoms of *Hakea*, *Eucalyptus*, *Dryandra*, &c., in early spring; one of my specimens was reared from the coccid *Brachyscelis strombylosa*.

The form described by the Rev. H. S. Gorham had a black head, reddish prothorax (the disc infuscate), black elytra with a narrow basal stripe, a moderately wide and slightly oblique median fascia, and a small apical spot on each side, red abdomen

I have had under examination the following colour-varieties:—

Var. A.—Median fascia almost white, apical spots wanting.

Var. B.—Prothorax immaculate; median fascia almost white, apical spots absent, legs (except anterior tibiæ) black.

Var. C.—Prothorax immaculate.

Var. D.—Prothorax immaculate, apical spots wanting.

Var. E.—Prothorax immaculate, apical spots wanting; legs black, except anterior tibiæ and inner portion of anterior femora.

Var. F.—Elytra (except for the basal marking) entirely dark.

Var. G.—Prothorax immaculate, elytra (except for the basal markings) entirely dark.

Var. H.—The same, except that the elytra have a decided coppery-green gloss.

LEMIDIA LABIATA, Gorham.

Of fourteen specimens of this species under examination scarcely two are alike in all details; the variety noted by the Rev. H. S. Gorham is perhaps less variable than the more typical forms. Of these one specimen has the pale elytral vittæ very close to the suture, wide and continuous from base to apex, but with a slight interruption at about the middle; one specimen with a black prothorax, and another with a discal blotch only, have each a very distinct and almost white transverse fascia just beyond the middle and almost touching the sides.

LEMIDIA SUBÆNEA, Gorham.

A specimen from Mount Kosciusko has all the legs infuscate.

CUPESIDÆ.

CUPES VARIANS, n. sp. (See Supplementary Note on p. 513.)

Flat, narrow, opaque. Of a rather dingy brown; elytra paler, in places feebly mottled; abdomen and legs concolorous with elytra. Head and prothorax densely and uniformly clothed with round muddy-grey scales, almost entirely concealing the derm; three basal joints of antennæ similarly clothed; the others with short setose pubescence of a rather dingy brown; scutellum with black scales; elytra with round stramineous (in places brown) scales covering the interstices, and placed round the foveæ in such a fashion as to cause them to appear to be granulate. Under surface uniformly clothed with round muddy-grey scales; tarsi, intermediate tibiæ and posterior legs with soft pubescence of a golden tinge, the legs elsewhere squamose.

Head (excluding mandibles) transverse; base widely and shallowly emarginate, a median impression continued from base to between antennæ, an impression on each side close to and continued around eyes. Mandibles stout, strong and irregularly punctate. Eyes large, round, prominent, minutely faceted. Antennæ terminating before middle of elytra, 1st joint large, apex oblique, 2nd small, 3rd-11th cylindrical, 3rd feebly constricted in middle, slightly longer than 1st or 4th, fully twice the length of 2nd, and equal to 11th, 4th-10th almost equal in length. *Prothorax* transverse, disc strongly excavated on each side, middle longitudinal raised and keel-like, and with a distinct median line; lateral margins somewhat raised, near apex projecting as an obtuse tooth; apex narrower than head, the base wider and bisinuate, from some directions appearing to be rounded. *Scutellum* convex, suboblong. *Elytra* almost four times the length of head and prothorax combined, at base about once and one-half the width of prothorax, near apex fully twice as wide; suture, 3rd, 5th (except at base) and 7th (especially at the shoulders) interstices raised and thickened, the interspaces with double rows of large square excavations or foveæ, sides oblique and with three uniform rows. Junction of *prosternum* with pronotum marked by a deep groove; abdomen long, the four basal segments feebly but distinctly transversely ridged. *Legs* thin; anterior tibiæ strongly, the intermediate feebly, curved; posterior straight. Length $13\frac{1}{2}$, width $4\frac{1}{3}$ mm.

Hab.—Sydney (types in Macleay Museum).

Not being at liberty to denude any of the (4) specimens before me, I have described the sculpture from what appears to be a partially abraded female specimen, the others appearing to be all males. The impressions on the head cause four raised spaces to appear on the disc, and a lobe behind each eye; of the discal spaces the two front ones are about half the size of the two hind ones, and all four are raised at their outer anterior edges.

The second specimen, marked as having been "captured on steps of Elizabeth Bay House, January 19th, 1864," differs in being much smaller (8 x 2¼ mm.), the head and prothorax densely clothed with pale fawn-coloured scales, which entirely conceal the derm and sculpture, and with stout darker scales appearing in places; the antennæ, owing to the much denser clothing, appear to be stouter and with shorter joints, the apical joints are finely pubescent, the basal are supplied with stout scales; the elytra are clothed as in the large specimen, but rather more regularly; on both this and the two following specimens the scales of the under surface are as in the large specimens, except that on the head and prosternum they are somewhat denser and paler.

The third specimen is much smaller and narrower (6 x 1½ mm), and has the head so densely clothed that the sculpture is entirely hidden ; the scales moreover have a slight reddish tinge.

The fourth specimen (6½ x 1⅗ mm.) appears (to the naked eye) to be prettily variegated with black and white, and the derm is considerably darker. The head, antennæ and prothorax are clothed as in the two preceding specimens, except that the prevailing colour is sooty, the flanks of the head and prothorax being of a very dingy white; elytra with sooty scales, and with large irregular patches of whitish scales towards the sides, one commencing at the shoulder and of a zig-zag shape which terminates beyond the middle, another almost fasciate near apex; the apex itself and part of the extreme margin with whitish scales.

CERAMBYCIDÆ.

PRIONOPLUS RETICULARIS, White.

Mr. Simson has shown me a living specimen of this fine New Zealand longicorn which was given him as having come from a window-sash made of kauri pine at Launceston (Tasmania).

COCCINELLIDÆ.

Coccinella religiosa, n.sp.

Briefly elliptic; shining. Upper surface glabrous, under finely pubescent. Testaceous; under surface slightly darker than upper but scarcely infuscate; scutellum dark red (in some specimens almost black); each elytron with four small round black spots (besides one common to both on suture near apex), one near middle of base, two slightly before middle (one of which is rather close to suture and the other equally close to the side) and one at about one-third from apex and slightly nearer side than suture.

Head feebly punctate; clypeus rounded in front, sides feebly angular, but not margining eyes; eyes very finely faceted. *Prothorax* about twice as wide as the length down middle, sides and base regularly rounded, sides feebly margined; moderately densely, but not strongly punctate. *Scutellum* transversely triangular. *Elytra* densely but not strongly punctate except on the slightly margined sides, a row of infuscate punctures (in a scarcely visible depression) commencing between basal spot and side, and continued along side (passing through lateral spot) to apex, but becoming diffused about suture; episterna wide, nowhere suddenly narrowed, feebly impressed near four posterior femora. Abdominal lamellæ almost touching 1st suture. Length 5⅓, width 4⅓ mm.

Hab.—Behn River, Wyndham, Derby, N.W.A. (Mr. R. Helms).

A very distinct species; the spots on each elytron are disposed in the form of a cross; on several the sutural spot is absent. I am not sure as to its correct genus, but no harm can result from placing it in *Coccinella*.

C. Kingi, Macl. *Hab.*—Tamworth, N.S.W.

C. repanda, Thunb. *Hab.*—New South Wales; Behn River, N.W.A.

C. arcuata, Fabr. *Hab.*—Tweed, Richmond and Clarence Rivers, N.S.W.

C. **TRANSVERSALIS**, Fabr. *Hab.*—South Australia, Victoria, Tasmania, New South Wales, Queensland; Rottnest Island, Gun Island, W.A.

CYCLONEDA BARRONENSIS, Blackb. *Hab.*—Barron Falls, N.Q.

NEDA TESTUDINARIA, Muls. *Hab.*—Coastal districts of New South Wales.

N. **BOURGEOISI**, De Ker. *Hab.*—New South Wales.

ALESIA FRENATA, Er. *Hab.*—Sydney.

A. **STRIGULA**, Boisd. *Hab.*—Richmond and Clarence Rivers.

CHILOMENES QUADRIPUSTULATUS, Muls. *Hab.*—West Australia (widely distributed).

LEIS CONFORMIS, Boisd., var. OCCIDENTALIS.*

Typical specimens (which I have from Queensland, New South Wales, Victoria and Tasmania) of this species do not occur in Western Australia; but from Mount Barker I have specimens of a very distinctly marked variety which I have named as above. The variety differs from typical specimens in having the prothorax black except for a narrow border at the apex and sides, or sides only, sometimes with a very narrow stripe along the front of the median line. On the elytra all the spots (with the exception of the humeral) are joined together, the 2nd and 3rd transverse rows (of typical specimens) appearing as a wide transverse fascia extending to both sides and suture, but with sinuous internal margins; on each shoulder is a large spot enlarged towards the suture, not two spots as in specimens from New South Wales and in the majority from Tasmania. The legs, with the exception of the tarsi, are entirely black.

I could find absolutely no differences in the eggs, larval stages, and pupæ of typical specimens and the variety, having had those of both under observation at the same time.

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* A text-figure of this variety has been given in the Journal of the Bureau of Agriculture of Western Australia for 1897, p. 1433.

HALYZIA MELLYI, Muls.

I have this species from Tasmania, Mt. Kosciusko, and S.W. Australia. The western specimens differ from the others in being smaller, the black markings reduced in size, and the third fascia broken up into two spots on each elytron.

H. GALBULA, Muls. *Hab.*—Sydney.

H. EDWARDSI, Muls. *Hab.*—Gosford, Richmond River, N.S.W.

H. PASCOEI, Crotch. *Hab.*—New South Wales.

COELOPHORA JANSONI, Crotch. *Hab.*—Somerset, N.Q.

C. GUTTATA, Blackb. *Hab.*—Cairns, N.Q.

C. MASTERSI, Blackb. *Hab.*—Somerset.

C. VERANOIDES, Blackb. *Hab.*—Sydney, Tweed River, N.S.W.; Behn River, N.W.A.

ORCUS PURPUREOTINCTUS, n.sp.

Metallic-blue with a purplish lustre; under surface (except epipleuræ), antennæ, palpi and legs yellow. Head with sparse fine golden pubescence in front.

Head moderately punctate; clypeus distinctly expanded on each side in front of eyes. Prothorax more densely punctate than head or elytra, its sides strigose. Epipleuræ shallowly foveate. Length 5 mm.

Hab.—Behn River, N.W.A. (Mr. R. Helms).

The extreme anterior margins of the prothorax are testaceous, but unless closely examined the whole upper surface appears to be blue; the head is somewhat green, with the dilated portions of the clypeus brown. The shape is that of *chalybeus*, but the punctures are decidedly stronger; *punctulatus* is described as having the prosternum concolorous with the abdomen. I have seen four specimens.

ORCUS CITRI, n.sp.

Blackish-blue with a slight coppery gloss; prothorax testaceous but darker along middle; under surface and legs piceous-blue or piceous with a coppery gloss; apex and sides of abdomen testaceous, the tarsi, knees and trochanter ferruginous.

Head densely punctate; clypeus strongly expanded on each side. Prothorax moderately densely punctate, the sides not strigose. Elytra densely and very distinctly punctate; epipleuræ not foveate. Length 3 mm.

Hab.—Tamworth, N.S.W. (on orange trees).

Appears to be allied to *splendens*, but very differently coloured. The punctures are much coarser than in *chalybeus*. On one specimen the dark marking of the prothorax somewhat resembles a ⊥ with the stem dilated in the middle; on a second specimen it is more like a mushroom; on both it appears to be fuscous with a coppery-green (or blue) gloss.

ORCUS AUSTRALASIÆ, Boisd.

This is a most variable species both as regards marking and size. With the exception of *C. transversalis* it appears also to be more widely distributed than any other Australian ladybird. My specimens vary in length from 4 to 7 mm. The ground colour is usually a bright metallic-blue, but I have specimens with a decided greenish gloss and others which are almost black. On typical specimens the spots vary considerably in size, and the humeral one in shape; on the variety *nummularis** the apical spots vary considerably in shape. I have another distinctly marked variety which I propose to name—

Var. QUADRINOTATUS.

In this variety the elytral spots are conjoined so as to form two transverse markings on each elytron, those at the base being more or less dumb-bell-shaped and interrupted close to suture; the apical spots are large and irregularly transversely oblong. All the specimens I have seen are from Western Australia; on one of them the basal and apical marks are joined by a narrow stripe towards each side.

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* Mr. A. Koebele informed the Rev. T. Blackburn that he found *nummularis* and *Australasiæ* to be distinct species, but in this he was certainly mistaken.

O. LAFERTEI, Muls. *Hab.*—Brisbane, Q.: Tweed River, N.S.W.

O. QUADRIMACULATUS, De Ker. *Hab.*—King's Sound, N.W.A.; Sydney, N.S.W.

O. BILUNULATUS, Boisd. *Hab.*—New South Wales, Tasmania.

O. CHALYBEUS, Boisd. *Hab.*—Brisbane, Sydney.

CHILOCORUS BAILEYI, Blackb. *Hab.*—Somerset, N.Q.

NOVIUS TRIDENS, n.sp.

Head, prothorax and scutellum piceous-black; sterna and legs (tarsi excepted) piceous, anterior tibiæ paler; elytra (including epipleuræ) sanguineous, the sides and suture clouded with piceous; on the sides not quite to base, on suture to base but rather indistinctly so; abdomen dull brownish-red. Clothed with short yellowish-white pubescence. Length 3 mm.

Hab.—Sydney, N.S.W.

Differs from *cardinalis*, besides markings, in being smaller, less convex, and with much finer punctures; the dark markings on the elytra are somewhat trident-shaped. The specimen described is from the collection of the late Mr. A. Sidney Olliff, and bears a label in the handwriting of the Rev. T. Blackburn "Novius sp.n."

NOVIUS IMMACULATUS, n.sp.

Piceous-black; antennæ, palpi, tarsi, four anterior and part of posterior tibiæ brownish-red. Clothed with short ashen pubescence.

Head and prothorax finely, elytra densely and moderately finely punctate. Abdomen with six segments. Length 2⅓ mm.

Hab.—Swan River, W.A.

In this species red has entirely disappeared from the upper surface. In shape it strongly resembles *N. Lindi*, and I should probably have taken it for a variety of that species but that the punctures are rather denser and stronger, and the pubescence is slightly longer and with a more decided yellowish tinge. A specimen from Geraldton (which appears to be immature) probably belongs to this species; it has the elytra the colour of dried blood, with the margins and epipleuræ and part of the abdomen reddish-testaceous.

NOVIUS BELLUS, Blackb.

This species is by no means constant as regards its markings. The ♂ (I have several pairs which were taken *in cop.*) is usually smaller and darker, the red sutural marking is frequently abbreviated, and sometimes divided into two portions; in the ♀ it is often shaped like a New Guinea fish-hook. I have specimens from New South Wales, South and West Australia. Western specimens are usually much darker than eastern ones I have one specimen in which each elytron is supplied with but three (rather small) distinct spots : one close to scutellum, one close to suture just before middle, and one humeral.

NOVIUS KOKBELEI (Olliff MS.).

This species was never described by the late Mr. A. Sidney Olliff, but as it is well known in the United States (where several coloured figures of it have been published) Mr. Olliff's name (unless indeed the species should prove to be synonymous with *sanguinolentus*) will probably stand. I have specimens from the Richmond River.

N. CARDINALIS, Muls. *Hab.*—New South Wales, Tasmania, West Australia.

N. LINDI, Blackb. *Hab.*—Swan River.

HYPOCERAS MULSANTI, Chp. *Hab.*—North Queensland.

RHIZOBIUS TRICOLOR, n.sp.

Elongate, subelliptic. Head, prothorax, sterna, legs (tarsi and knees excepted) black; elytra blue (in places and from some directions with a greenish or coppery gloss); antennæ, palpi and abdomen blood-red. Rather densely clothed with white pubescence which is waved on the elytra.

Densely punctate, the head and prothorax moderately finely, the elytra coarsely except in the vicinity of the (slightly raised) suture. Metasternum rather coarsely punctate and transversely wrinkled. Abdominal lamellæ more coarsely punctured than and terminated considerably before apex of basal segment. Length 5, width 3½ mm.

Hab.—Hobart, Tas. (Griffith & Lea).

Much larger than the three blue species (*cyaneus*, *cœruleus* and *eminens*) hitherto described and the under surface differently coloured. To the naked eye the elytra appear to be devoid of pubescence in patches, and these patches vary in position as the insect is moved.

RHIZOBIUS CALOMELOIDES, n.sp.

Rather elongate-elliptic. Dark yellowish-red (almost sanguineous), prothorax with a piceous blotch on each side of middle, elytra (margins and suture excepted) piceous-brown or chocolate-red. Clothed with rather long yellowish pubescence interspersed with longer straggling hairs of a similar colour; pubescence of under surface similarly coloured but unmixed and shorter.

Head somewhat irregularly but rather feebly punctate. Prothorax densely, moderately strongly and somewhat irregularly punctate; scarcely twice as wide as the length down middle; sides strongly rounded. Elytra densely, coarsely and irregularly punctate and with small punctures interspersed, near suture a few large ones causing an appearance almost of striation, suture itself feebly punctate. Intercoxal process of prosternum feebly depressed, its sides distinctly carinate. Metasternum almost impunctate in middle, towards sides becoming rather densely punctate. Abdomen densely punctate, the basal segment irregularly so, largest punctures immediately behind lamellæ, these small, shining and rather strongly punctate. Length 5, width 3½ (vix) mm.

Hab.—Tasmania (Mr. A. Simson, No. 3620), Hobart (Griffith & Lea).

The piceous blotches of the prothorax (to the naked eye) appear to be conjoined and to occupy about one-third of the surface; the elytra (except along the margins and suture) are almost the colour of dried blood. The character of the markings and the shape of this species are reminiscent of *Calomela*.

RHIZOBIUS VIRGATUS, n.sp.

Oblong-ovate, rather strongly convex, shining. Dark red; mouth-parts, antennæ and legs paler; each elytron with two longitudinal black stripes, the inner commencing near base and terminating near apex, the outer midway between the inner black stripe and the margin and joined to the inner stripe at its apex but not at its base. Clothed with moderately dense and rather long ashen pubescence interspersed with numerous long erect dark setæ; under surface finely pubescent.

Head and prothorax finely, the elytra densely and coarsely but almost regularly punctate, punctures finer in vicinity of suture than elsewhere. Intercoxal process of prosternum depressed, rather wide, not at all triangular. Metasternum moderately strongly punctate and very feebly transversely wrinkled. Abdomen feebly punctate in middle, moderately strongly at sides; lamellæ terminating at about one-third from suture. Length 2¼ mm.

Hab.—Hobart.

Resembles *dorsalis* in shape and in colour to a certain extent, but differs in having two black and three dark red stripes on each elytron, in the setæ being considerably longer and the punctures coarser.

RHIZOBIUS ALPHABETICUS, n.sp.

Ovate, moderately convex and moderately shining. Pale testaceous; prothorax clouded with piceous in middle; elytra with angular and variable piceous markings; under surface reddish-testaceous, the sides infuscate or not; mouth-parts, antennæ, legs and epipleuræ testaceous. Clothed with moderately short yellowish pubescence mixed with a few short and scarcely visible setæ.

Elytra densely and (except in immediate vicinity of suture) rather coarsely punctate. Intercoxal process of prosternum rather wide and depressed. Metasternum and basal segment of abdomen scarcely visibly punctate in middle; apical segments moderately strongly punctate; lamellæ extending but little more than half way to first suture. Length $1\frac{3}{5}$-$2\frac{1}{4}$ mm.

Hab.—Tasmania (Mr. A. Simson, No. 3804), Hobart, Bruni Island (Lea).

Of four specimens under examination no two have the elytral markings alike; on three of them the suture is narrowly piceous throughout, on the fourth it is scarcely darkened. On one the piceous markings form an irregular U behind the scutellum, and about the middle of each an irregular h (correct on the left and reversed on the right elytron) joined together by a transverse fascia at about one-third from apex; on another specimen the h is present but rather indistinct, and the basal U is not continued across suture; on the third specimen the markings are much narrower and consist of a short broad U near the base, a transverse fascia at one-third from apex and a slightly curved and disconnected stripe slightly nearer the side than suture; the fourth specimen resembles the third to a certain extent, but the markings are less sharply defined and the basal U appears as a V.

RHIZOBIUS CORTICALIS, n.sp.

Oblong-ovate, subdepressed, feebly shining. Reddish-brown or brownish-red, prothorax slightly paler than elytra; head, under surface (including epipleuræ) and appendages dark testaceous (or brownish) red; metasternum slightly infuscate or not. Densely clothed with short yellowish pubescence (more or less waved on elytra) interspersed with long brownish setæ, which are more numerous at the sides than on the middle.

Prothorax comparatively strongly punctate. Elytra densely and strongly punctate. Intercoxal process of prosternum wedge-shaped, its sides carinate. Metasternum distinctly transversely wrinkled and (except for a rather large space about middle of apex) coarsely punctate. Abdomen densely punctate, punctures less regular and smaller on basal segment than elsewhere, but a few large ones at extreme base between coxæ; lamellæ terminating at about one-third their length from suture. Length 3-3⅔ mm.

Hab.—Geraldton, W.A. (under bark of *Nuytsia floribunda*).

Close to *discolor*, but the clothing very different and punctures of under surface less regular; the colour also is different.

RHIZOBIUS CONFINIS, n.sp.

Oblong-ovate, moderately convex, shining. Reddish-brown; anterior (and less distinctly the lateral) margins of prothorax, head, under surface (epipleuræ piceous-brown and metasternum red) and appendages testaceous. Clothed with moderately short white hairs (feebly waved on elytra), mingled with yellowish erect setæ.

Punctures of prothorax and elytra and shape of prosternum as in the preceding. Metasternum densely, strongly and almost regularly punctate throughout and feebly transversely wrinkled. Abdomen densely punctate, the basal segment irregularly so, but rather coarsely between coxæ; lamellæ extending to about one-fourth from suture. Length 3⅓ mm.

Hab.—Garden Island, W.A.

Remarkably close to the preceding species, but differs in being more convex, paler, setæ and epipleuræ differently coloured and punctures of metasternum very different.

RHIZOBIUS OCCIDENTALIS, Blackb.

Pale testaceous, under surface (except epipleuræ which are very pale) darker; metasternum slightly infuscate or not; elytra with piceous or brown, and more or less variable markings. Length 1⅓-1⅔ mm.

Hab.—Swan River, Vasse, Rottnest Island, W.A.

On each of four specimens there are two short transverse arcuate fasciæ (the convex side directed towards apex), a narrow one just behind middle and a wider one between it and apex, a faint blotch on each side at base, and signs of a feeble sublateral stripe; on a fifth specimen the median fasciæ are absent; on a sixth all the markings are present but the lateral stripe is distinct and joined to the basal spot; on a 7th (and very pale) specimen the two fasciæ appear more like small spots, each of the basal spots is very small, and the lateral stripe has disappeared except for a small spot opposite the apical fascia. Of the seven specimens, five have the prothorax absolutely clear; in the other two there is a slight fuscous tinge in the middle; the sutural line is narrow in all.

I had a full description of this species written out as new, but thinking it possible that Mr. Blackburn's unique type of *occidentalis* was one of its varieties, asked his opinion thereon, and he stated that the specimen I sent him was certainly *occidentalis.*

RHIZOBIUS HIRTELLUS, Crotch.

I have numerous specimens which I refer to this species, and which have the head, prothorax and legs red, the elytra piceous with a coppery gloss, and clothed with ashy pubescence mingled with longer and darker hairs. In many of them the sterna and abdomen are piceous, sometimes ferruginous; occasionally the abdomen is dark ferruginous with indistinct reddish blotches at the sides; several specimens have the elytral margins diluted with red; the legs are occasionally tinged with piceous; on several there is a feeble piceous cloud on the disc of the prothorax. The pubescence varies in density and slightly in length. The smaller specimens are generally more convex than the larger ones. The size varies from 1½ to 3 mm. I have specimens from Brisbane Q.; Sydney, Forest Reefs and Tamworth, N.S.W.; Hobart, Tasm.; and Geraldton, Pinjarrah, Swan River, Rottnest and Garden Islands, Boyanup, Darling Ranges and Mount Barker, W.A. The species is a very useful one, and may frequently be seen in citrous and other orchards, where it feeds especially on the "San Jose," "red" and "greedy" scales (*Aspidiotus perniciosus, aurantii* and *rapax*); its larvæ are severely parasitised by a Chalcid wasp.

RHIZOBIUS DISCIPENNIS, Blackb.

A specimen (from the Richmond River) under examination probably belongs to this species, but it differs from the Rev. T.

Blackburn's description in being smaller (not quite 2 mm.), and in having the elytra black except for a rather indistinct reddish vitta on each side (extending from about one-fourth from base to one-fourth from apex). The lævigate sutural space extends to about the middle, and is very distinctly margined by large and closely seriate punctures. The basal segment of abdomen is densely and rather coarsely punctate, the punctures being denser, but somewhat smaller and deeper than those of metasternum.

RHIZOBIUS BREWERI, Crotch.

Two specimens from the Swan River possibly belong to this species, as they are very closely allied to *discolor;* besides the differences mentioned by Mr. Crotch, they are slightly more convex, and with setæ distributed amongst the pubescence.

R. SATELLES, Blackb. *Hab.*—Clarence River, Armidale, Sydney, Gosford, N.S.W.

R. CŒCUS, Blackb. *Hab.*—Sydney, Gosford, N.S.W.

R. PULCHER, Blackb. *Hab.*—Glen Innes, Armidale, N.S.W.; Hobart, Bruni Island, Tasm.

R. NIGRONOTATA, Blackb. *Hab.*—Gosford, N.S.W.

R. UMBRATUS, Blackb. *Hab.*—Mount Lofty, S.A.

R. APICALIS, Blackb. *Hab.*—Sydney, Armidale, N.S.W.

R. NITIDUS, Blackb. *Hab.*—Mount Barker, Swan River, W.A.

R. FUGAX, Blackb. *Hab.*—Forest Reefs, Glen Innes, N.S.W.; Melbourne, Vic.

R. PLEBEIUS, Blackb. *Hab.*—Sydney.

R. INSIPIDUS, Blackb. *Hab.*—Sydney.

R. LINDI, Blackb. *Hab.*—Swan River, Rottnest Island, Geraldton, W.A.; Sydney, N.S.W.; Hobart, Tasm.

R. BOUCARDI, Crotch. *Hab.*—New South Wales.

R. VENTRALIS, Er. *Hab.*—Tasmania, New South Wales, West Australia.

R. DISCOLOR, Er. *Hab.*—Tasmania, New South Wales.

CRYPTOLÆMUS MONTROUZIERI, Muls. *Hab.*—New South Wales; widely distributed.

SCYMNUS STRIATUS, n.sp

Suboblong, strongly convex, shining. Testaceous; elytra with fuscous markings; legs testaceous, under surface darker.

Upper surface densely and finely punctate; elytra with an appearance as of striation especially near the suture. Intercoxal process of prosternum truncate, sides carinate. Sterna (except middle of metasternum) and abdomen rather densely punctate; 1st suture just traceable across middle; lamellæ extending to suture. Length $1\frac{2}{3}$-2 mm.

Hab.—North West Australia (Macleay Museum).

At first sight not unlike some of the paler varieties of *Sydneyensis*, but narrower, more parallel-sided, and with different punctures to that species. The markings are tortoise-shell-like, but are nowhere sharply defined. On one specimen there is a moderately well defined dark spot on each side of elytra at base, a transverse similarly coloured irregular fascia beyond middle (moderately well defined on its posterior edge only, and not extending to sides), and a feeble fascia near apex; between these two is a well defined pallid zig-zag fascia. The other and larger specimen is paler, and with the markings still more obscure. On both the suture and base of elytra are dark brown. The elytra appear to be feebly striate owing to rows of punctures (not distinctly traceable themselves) being infuscate; of these rows only one (on each side of the suture) is at all sharply defined, the others being traceable with more or less difficulty.

SCYMNUS TRILOBUS, n.sp.

Ovate, moderately convex, shining. Black; apical two-fifths of elytra, abdomen, mouth-parts, antennæ, tibiæ and tarsi reddish-testaceous; coxæ, trochanter, base and apex of femora dark red; epipleura piceous. Moderately densely clothed with whitish pubescence.

Densely, the elytra rather coarsely, punctate; punctures finer at apex and along suture than elsewhere. Intercoxal process of prosternum wide, truncate at base and apex, feebly constricted in middle, sides carinate. Metasternum indistinctly transversely wrinkled. Abdomen moderately densely punctate; lamellæ extending to suture, this just traceable across middle. Length 2⅓ mm.

Hab.—Armidale, N.S.W.; Hobart, Tasm.

I believe the specimen under examination to be ♂, although the head and prothorax are entirely black. The apical patch of the elytra appears to be almost trilobed owing to its slight extension along suture and sides. In colour it resembles *Rhizobius apicalis* and (except for the under surface and legs) the ♀ of *S. Meyricki.*

SCYMNUS INDISTINCTUS, n.sp.

Oblong-ovate, convex, shining. Black; head, anterior angles of prothorax, mouth-parts, antennæ, anterior legs and all the tarsi testaceous; four posterior tibiæ (with or without the femora) piceous- or testaceous-brown; basal half of epipleuræ brownish; apical third of elytra with a somewhat obscure reddish blotch. Clothed with fine, ashen-yellow pubescence.

Densely, the elytra moderately coarsely, punctate. Intercoxal process of prosternum wide, truncate; sides finely carinate. Metasternum polished, and almost impunctate in middle. Abdomen densely punctate; lamellæ narrowly touching suture, this traceable across middle with great difficulty. Length 1⅘-2 mm.

Hab.—Forest Reefs, N.S.W.

Somewhat resembles *Meyricki* in colour, but less ovate and considerably smaller than that species, the apical markings more obscure, &c. I have three specimens (all males) under examination.

SCYMNUS TRIANGULARIS, n.sp.

Oblong-ovate, depressed, feebly shining. Testaceous; under surface (except epipleuræ) and a large triangular elytral patch infuscate. Clothed with very fine ashen pubescence.

Intercoxal process of prosternum truncate. First ventral suture obsolete in middle. Length 1 mm.

Hab.—Windsor, N.S.W. (two specimens in flood débris).

With the exception of *vagans*, this is the smallest species I am acquainted with in the genus. The elytra have a brownish patch extending almost across the entire base, its sides directed obliquely to suture near apex (but feebly incurved), so that in shape it is much like an isosceles triangle; the sides are paler than the head and prothorax. Under a Coddington lens I have not been able to see any punctures, nor have I been able to so fix the legs as to expose the abdominal lamellæ.

SCYMNUS COMPOSITUS, n.sp.

Elliptic-oblong, moderately convex, shining. Reddish-testaceous; sterna and abdomen (apex excepted or not) darker; elytra paler but marked with fuscous at base (except near extreme shoulders), rather widely along suture, at apex, and rather indistinctly at sides. Rather densely clothed with short ashen pubescence, as long on under as on upper surface.

Head and prothorax minutely, elytra comparatively strongly, punctate. Intercoxal process of prosternum comparatively narrow and strongly carinate. Abdomen moderately densely punctate; 1st suture traceable across middle; lamellæ not quite extending to suture, and rather more coarsely punctate than elsewhere. Femora stouter than usual. Length $1\frac{5}{8}$ mm.

Hab.—Tamworth, N.S.W.

In colour and shape closer to the preceding than any other species with which I am acquainted; but apart from the great difference in size, it differs in having the sutural marking much less triangular and dilated at the apex, and with the sides infuscate, so that each elytron appears to be supplied with a somewhat elliptic testaceous blotch.

SCYMNUS MIMICUS, n.sp.

Elliptic-ovate, moderately convex, moderately shiny. Prothorax (sides and anterior edge excepted), scutellum, sterna and abdomen (apical segments more or less diluted) piceous or piceous-brown; head and epipleuræ brown; femora testaceous-brown, tibiæ and tarsi pale testaceous; elytra obscure brownish-testaceous, with piceous spots more or less conjoined and distinct or not; suture and sides narrowly piceous. Clothed with short ashen pubescence, rather longer on sides of prothorax than elsewhere; under surface (except at sides, and then but moderately) sparsely and very finely pubescent.

Upper surface very finely and (elytra included) indistinctly punctate. Intercoxal process of prosternum moderately wide, its sides rather finely carinate. Metasternum rather strongly punctate at sides, but finely in middle. Abdomen moderately strongly punctate; 1st suture traceable across middle; lamellæ large, touching suture for the greater part of their width, more distinctly punctate at sides than towards middle. Length 2⅗ mm.

Hab.—Tamworth, N.S.W.

On the elytra there is a quadrangular spot close to the base, from each of the anterior angles of which an indistinct stripe is directed to each shoulder; from each of its posterior angles a short stripe is directed hindward, and terminates in a round spot, the whole (if the scutellum is included) bearing a ludicrous resemblance to a man with outstretched arms and legs; on each side between this figure and the side is a U-shaped dark patch, the latter rather indistinct owing to a small spot between its terminations; at about one-third from apex there is an indistinct narrow transverse stripe, and the apex itself is slightly infuscate. The suture appears to be finely carinate, but this appearance is caused solely by its colour. In shape and colour this species strongly resembles many of the species belonging to *Trogoderma* of the *Dermestidæ*.

SCYMNUS VITTIPENNIS, n.sp.

Ovate, moderately convex, shining. Piceous-black; under surface (apical segments of abdomen paler) piceous-brown; mouth-parts, antennæ, legs and basal half of epipleuræ testaceous; each elytron with a very distinct testaceous and moderately wide vitta, commencing on each shoulder and not quite reaching apex or suture. Clothed with moderately short ashen pubescence.

Elytra moderately distinctly punctate. Intercoxal process of prosternum rather wide and depressed. Abdomen moderately densely punctate; 1st suture traceable (in certain lights) across middle; lamellæ rather large, but touching suture for but a very short distance. Length 1¾ mm.

Hab.—Forest Reefs, N.S.W.

The testaceous vittæ of the elytra touch the extreme margins in the humeral regions only.

SCYMNUS PECTORALIS, n.sp.

Oblong-ovate, moderately strongly convex, shining. Pale brownish-testaceous; head, sides and anterior margins of prothorax slightly paler; scutellum piceous; each elytron with about five small pale testaceous blotches (moderately well defined to the naked eye, but indistinct under a lens); suture near base with a brownish blotch, from each of the anterior angles of which an indistinct oblique stripe connects it with an angular and well defined spot; meso- and metasternum shining black, all the rest of the under surface (except basal segment of abdomen and epipleuræ, which are slightly infuscate) and the appendages testaceous. Clothed with short ashen pubescence similar on both under and upper surfaces.

Upper surface finely (scarcely visibly) punctate. Elytral suture finely carinate. Intercoxal process of prosternum flattened, its sides finely carinate. Abdomen densely and comparatively strongly punctate; 1st suture traceable across middle (from some directions rather distinctly so); lamellæ large and wide, but nowhere (behind the coxæ almost) touching suture. Length 2 mm.

Hab.—Armidale, N.S.W.

The spots or blotches are much more distinct in the vicinity of the scutellum than elsewhere, the elytra there having the appearance of tortoise-shell. The metasternum is almost as visibly punctate in the middle, and almost as densely clothed as at the sides. The markings are very different from those of any species with which I am acquainted; the shape is much the same as that of *obumbratus*.

SCYMNUS FRATER, n.sp.

♂. Oblong-ovate, convex, moderately shiny. Black; abdomen dark brown; head down middle, anterior angles of prothorax, mouth-parts, antennæ, anterior legs, part of four posterior tibiæ, and all the tarsi testaceous. Clothed with dense, moderately short, yellowish pubescence.

Elytra densely and (for the genus) rather strongly punctate, punctures clearly defined. Intercoxal process of prosternum wide, depressed, constricted in middle. Abdomen (except basal segment) densely punctate; 1st suture distinct across middle; lamellæ touching suture for a considerable part of their width. Length 2½ mm.

♀. Differs in having the head and prothorax entirely black; the legs (except the tarsi which are testaceous, and the anterior tibiæ which are obscure brown) are also black.

Hab.—Galston (Mr. W. Dumbrell), Armidale and Tamworth (Lea), N.S.W.

Of the shape of *flavifrons*, but very much larger, and colour, &c., different. The 1st ventral suture is very distinct from all directions except when seen from the head; it is not deeply impressed, however. The eyes are large, finely faceted, and not at all oblique in position.

SCYMNUS ELUTUS, n.sp.

Elliptic-ovate, subdepressed, shining. Head and prothorax piceous; elytra brownish-testaceous, the suture narrowly piceous; under surface dark reddish-brown; mouth-parts, antennæ, legs and epipleuræ testaceous. Clothed with moderately short ashen pubescence.

Elytra distinctly but not very coarsely or densely punctate; suture feebly carinate towards apex. Intercoxal process of prosternum flat, moderately wide; sides finely carinate. Abdomen densely punctate; 1st suture traceable with great difficulty (and only from certain directions) across middle; lamellæ touching suture for the greater part of their width. Length 1⅖ mm.

Hab.—Forest Reefs, N.S.W.

The suture, owing to its colour, appears to be carinate throughout, but is really carinate (and very feebly so) only towards apex. I have a specimen from Hobart which I believe belongs to this species, but which has the femora piceous.

SCYMNUS VAGANS, Blackb.

A common species widely distributed in New South Wales, Tasmania and Western Australia, and which may frequently be seen feeding on "red spider" (*Tetranychus telarius*). Two Tasmanian specimens have the elytra dark reddish-brown instead of black.

SCYMNUS FLAVIFRONS, Blackb.

Widely distributed in New South Wales, Tasmania and Western Australia, and very variable in size and to a certain extent in colour.

S. NOTESCENS, Blackb. *Hab.*—New South Wales, South Australia, Western Australia, Tasmania.

S. SYDNEYENSIS, Blackb. *Hab.*—Tamworth, Armidale, Forest Reefs, N.S.W.; Brisbane, Q. (A beautiful and very variable species).

S. MEYRICKI, Blackb. *Hab.*—Forest Reefs, N.S.W.; Geraldton, Swan River, W.A.

S. INSIDIOSUS, Blackb. *Hab.*—Inverell, N.S.W.

S. MITIOR, Blackb. *Hab.*—Clarence River, N.S.W.

S. WHITTONENSIS, Blackb. *Hab.*—Whitton, N.S.W.

S. INAFFECTATUS, Blackb. *Hab.*—Sydney.

S. IMPICTUS, Blackb. *Hab.*—Tweed and Richmond Rivers, N.S.W.

S. OBUMBRATUS, Blackb. *Hab.*—Glen Innes, Armidale, N.S.W.

S. AUSTRALASIÆ, Blackb. *Hab.*—Tamworth, Forest Reefs, N.S.W.

S. PARALLELUS, Blackb. *Hab.*—Forest Reefs.

S. AUSTRALIS, Blackb. *Hab.*—Geraldton, W.A.

PLATYOMUS IMMACULATUS, Blackb. (*P. Eugeniæ*, Blackb.).

I have a pair of *immaculatus* which were taken *in cop.* at Tamworth; the female differs from the male in having the head, prothorax and anterior femora entirely black (or piceous) and with the anterior tibiæ piceous on their outer edge. Mr. Blackburn thought it probable that his *Eugeniæ* was the female of *immaculatus; Eugeniæ* is said to differ in having the legs (tarsi excepted) and the head black; in the female under examination the anterior tibiæ are yellow, except outwardly. I have a specimen (from Sydney) which is probably *Eugeniæ* and which has the legs (with the exception of the tarsi) entirely black; the prothorax is without the feeble frontal spots of the male of *immaculatus* and the punctures of the elytra are very regular (more noticeably so than in *P. Koebelei*).

P. CONSIMILIS, Blackb. *Hab.*—Forest Reefs, Tamworth, N.S.W.

P. LIVIDIGASTER, Muls. *Hab.*—Dalmorton, Tweed River, Byron Bay, Gosford, N.S.W.

P. KOEBELEI, Blackb. *Hab.*—New South Wales.

ERITHIONYX ALBATUS, n.sp.

Briefly ovate, strongly convex, shining. Black (with a brownish tinge); mouth-parts, antennæ, tarsi and abdomen reddish. Densely clothed with dull white semierect pubescence; under surface finely and sparsely pubescent, the femora with yellowish pubescence.

Upper surface densely, rather strongly, and almost regularly punctate; elytra more coarsely than prothorax; epipleuræ very densely punctate. Intercoxal process of prosternum rather wide and flat, its sides carinate. Metasternum rather strongly punctate, and distinctly transversely wrinkled. Abdomen moderately punctate; lamellæ rather small, more coarsely punctate than elsewhere, terminated one-fourth from suture. Length 3, width 2½ mm.

Hab.—Gosford, N.S.W.

At once distinguished from *lanosus* by its smaller size and white pubescence, which is also rather less erect and without the silken gloss of that species.

E. LANOSUS, Blackb. *Hab.*—Nerang, Q.

BUCOLUS NUYTSIÆ, n.sp.

Wide, depressed, shining. Reddish-brown; head, prothorax in middle, elytra along suture and towards sides, clouded with piceous; under surface and legs brownish-red, sterna slightly infuscate. Clothed with very short yellowish pubescence; under surface with longer, paler and sparser pubescence, becoming rather long and straggling at sides of abdomen.

Densely and finely punctate, the elytra more noticeably than prothorax or head. Metasternum impunctate. Epipleuræ and abdomen finely punctate, basal segment of the latter from some directions apparently longitudinally strigose; lamellæ glabrous, impunctate, not extending to suture. Tibiæ strongly compressed, slightly angular outwardly. Length 3¾, width 3; variation in length 3-4 mm.

Hab.—Geraldton, Donnybrook, W.A. (beneath bark of the "Christmas Tree," *Nuytsia floribunda*).

To the naked eye the whole upper surface appears to be of a dark chestnut-brown, the piceous markings being scarcely traceable even with a glass; from some directions, however, they appear to be marked by two obscure testaceous maculæ (or vittæ). The antennæ extend back to the mesosternum; the anterior angles of the prothorax are slightly in advance of the head, and the outline of the elytra is continuous with that of the prothorax.

BUCOLUS NIGRIPES, n.sp.

Wide, depressed, feebly shining. Piceous-black; flanks of prothorax and disc of each elytron (usually very indistinctly) diluted with red; under surface (middle of prosternum infuscate) except epipleuræ reddish-testaceous or pale chestnut-brown; legs shining black, tarsi reddish. Clothing as in the preceding species.

Densely and finely punctate, the elytra more noticeably than head or prothorax. Metasternum feebly, the abdomen more strongly (but rather irregularly) punctate; lamellæ shining, impunctate, nearly extending to suture. Tibiæ compressed, outer edges very feebly rounded. Length 4 (vix), width 3⅓ mm.

Hab.—Tamworth, N.S.W.

Besides colour it differs from the preceding species in being slightly more convex, with rather stronger abdominal punctures, the elytral punctures equal throughout, not (as in that species) absent along suture, and with the tibiæ decidedly less angular.

BUCOLUS OBSCURUS, n.sp.

Moderately wide, depressed, shining. Black; abdomen, tarsi and antennæ reddish-brown; metasternum black or piceous. Clothing as in the two preceding species.

Densely and finely punctate, the prothorax fully as densely and but little less coarsely than elytra. Metasternum punctate at sides only. Abdomen finely and irregularly punctate; lamellæ shining, punctate at base, not extending to suture. Tibiæ strongly compressed, outwardly rounded. Length 3⅙, width 2⅔ mm.

Hab.—Frankford, Tasm. (Mr. J. J. Towers).

Smaller and more elongate than either of the preceding species, from both of which it may also be distinguished by its colour and by the prothoracic and elytral punctures being almost equal. In one specimen the abdomen is almost piceous, and in both the base of the first segment is darker than elsewhere.

A specimen from Forest Reefs, N.S.W., probably belongs to this species; it differs only in having the legs piceous-brown (slightly darker than the metasternum) and the entire abdomen reddish-testaceous. Neither the head nor flanks of its prothorax are paler than its elytra.

B. FOURNETI, Muls. *Hab.*—Armidale, N S.W.

BUCOLELLUS ORNATUS, Blackb.

This pretty species is common in myrtaceous scrub about the coastal districts of Western Australia (I have specimens from

Swan River, Mount Barker, Albany and Karridale). The type specimen (judging by the description) appears to have been somewhat discoloured, as in nearly all the specimens under examination the pale testaceous markings (which are exactly as described and are not at all or very slightly variable) are sharply defined. Specimens vary in length from $\frac{4}{5}$ to 1 line.

SERANGIUM MICROSCOPICUM, n.sp.

Briefly ovate, moderately convex, highly polished. Black; mouth-parts, antennæ and legs flavous. Head and prothorax with a few, the elytra with still fewer straggling whitish hairs.

Upper surface not visibly, the under surface finely punctate. Length 1 mm.

Hab.—Behn River, N.W.A. (Mr. R. Helms).

Like *bicolor*, but at once distinguished by its much smaller size and pallid legs.

SERANGIUM NIGRUM, n.sp.

Briefly ovate, strongly convex, moderately polished. Black; tarsi testaceous or ferruginous, apical half of posterior tibiæ testaceous or not. Upper surface clothed with long, straggling, yellowish-white pubescence, rather denser on prothorax than on elytra; under surface (middle of metasternum glabrous) with fine yellowish pubescence.

Elytra with very fine punctures; under surface (except at sides of abdomen) indistinctly punctate. Length 2 mm.

Hab.—Hobart, Tasm.

The entirely black (except for tarsi and occasionally part of tibiæ) colour should render this species easily recognised; from *bicolor* it differs (besides colour) in being larger, with longer and more regular pubescence and with punctate elytra; the punctures, though small, are traceable with a Coddington lens. From above (except that it is less densely clothed) it strongly resembles *Erithionyx lanosus* in miniature.

SERANGIUM PUNCTIPENNE, n.sp.

Briefly ovate, strongly convex, highly polished. Black; mouth-parts, antennæ and tarsi obscure testaceous. Head and prothorax with long white pubescence, continued on to base and (very feebly) along the sides of elytra; under surface (except at sides) highly polished and almost glabrous.

Elytra with regular and very distinct, but not dense or coarse, punctures; prothorax with somewhat similar punctures, but partially concealed by clothing. Sterna punctate at sides. Abdomen rather coarsely but somewhat irregularly punctate, the basal segment being impunctate across middle (except at base and apex), and the other segments indistinctly punctate in middle; lamellæ distinctly punctate. Length 1⅔ mm.

Hab.—Tamworth, N.S.W.; Geraldton, W.A.

Like *bicolor*, from which it is distinguished by its very evident punctures and by its clothing. The specimens from Geraldton are smaller (1½ mm. only) than those from Tamworth, and the tarsi are almost piceous, but I do not think that they represent a distinct species.

SERANGIUM MÆSTUM, n.sp.

Briefly ovate, strongly convex, moderately polished. Dark brownish-black; legs brown; tarsi, tibiæ (wholly or in part), antennæ and palpi testaceous; epipleuræ and apical segments piceous-brown. Upper surface with long, straggling, yellowish pubescence, almost absent in middle; flanks of sterna and the legs finely pubescent.

Elytra just perceptibly punctate; epipleuræ distinctly excavated to outer margin to receive hind femora. Sterna impunctate in middle. Abdomen moderately strongly punctate; a transverse impunctate space in middle of basal segment. Length 1⅔ mm.

Hab.—Swan River, Geraldton, W.A.

Very close to *bicolor*, but the pubescence longer, more evenly distributed and darker, and with the elytra feebly (but noticeably) punctate. The colour of the derm also is not of the intense black so characteristic of that species. In the seven specimens under examination a central space occupying from behind scutellum to the apical half of elytra is almost entirely devoid of clothing.

[illegible], n.sp.

[illegible] ovate, moderately convex, not very highly polished. Black; mouth-parts and legs piceous, the anterior tibiæ somewhat paler. Clothed (except on middle of elytra) with moderately long whitish pubescence; under surface almost glabrous.

Elytra densely, regularly and finely but distinctly punctate. Under surface punctate at sides, and basal segment of abdomen across middle. Length 1¼ mm.

Hab.—New South Wales.

Differs from [illegible] by the elytra being noticeably punctate and less polished; from the (as above noted) Geraldton specimens of [illegible] by having the elytra much more densely punctate, but the punctures finer and less distinct; from the preceding it is readily distinguished by its clothing, and by the colour of its legs.

S. [illegible], Blackb. *Hab.*—West Australia. Widely distributed.

S. [illegible], Blackb. *Hab.*—Richmond River, N.S.W.

S. [illegible], Blackb. *Hab.*—Sydney, Gosford, N.S.W.; Wynd[illegible]

[illegible] Blackb. *Hab.*—Sydney.

[illegible] Blackb. *Hab.*—[illegible] Reefs, N.S.W.; [illegible]

[illegible] Blackb. *Hab.*—Swan River, Geraldton, W.A.

[illegible] Blackb. *Hab.*—Inverell, Gosford, Armidale, [illegible], N.S.W.

MIDUS PYGMÆUS, Blackb. *Hab.*—Sydney.

EPILACHNA GUTTATOPUSTULATA, Fabr. *Hab.*—New South Wales, Queensland.

E. 28-PUNCTATA, Fabr. *Hab.*—New South Wales, Queensland, North West Australia.

SUPPLEMENTARY NOTE.—After the description of *Cupes varians* (p. 485) left my hands I had the opportunity of seeing three other specimens—one from Wentworth Falls (N.S.W.) in the collection of Mr. A. Simson; one, without locality, presented to me by Mr. French; and one quite recently taken at Sheffield, in Tasmania, by Mr. G. M. Griffith and given to his brother, Mr. H. H. D. Griffith. The Tasmanian specimen measures 12 mm. in length, and each of the scales on the head, prothorax and antennæ is distinctly traceable; the margins of the prothorax are slightly waved posteriorly and distinctly emarginate on each side of the anterior tooth (the sculpture of the prothorax is probably the same in the other specimens but obscured by the clothing); its antennæ extend back to slightly beyond the middle of the elytra, and the terminal joint is slightly longer than the third. On both it and the specimen from Mr. French dark scales on the elytra are disposed in stripes on the alternate interstices, four dark stripes being on the second and two on the fourth before their iunction near the apex (*Feb. 10th, 1902*).

NOTES AND EXHIBITS.

The President exhibited a large photograph of the obelisk in the Botanic Gardens, Sydney, erected to the memory of Allan Cunningham in 1844, and which since June, 1901, has in the upper portion of the obelisk contained his mortal remains. These were removed from the Devonshire-street Cemetery in May, 1901, where they have reposed since June, 1839. Also a small collection of plants from the Sahara showing the strong superficial resemblance to our own desert flora. The resemblance is more than superficial in some cases, the same genera being often represented in the two floras.

Mr. T. Steel exhibited the following specimens of interest from New Zealand:—Maori Rat, *Mus exulans;* New Zealand Frog, *Liopelma Hochstetteri;* Tuatara Lizard, *Hatteria punctata;* Lizard, *Naultinus ornatus;* Fish, *Acanthoclinus littoreus* and another little fish with sucker disc, found very abundantly under stones between tides in Auckland Harbour; Porcelain Crab, *Petrolisthes elongatus*, found in excessive abundance associated with above fishes; Fresh-water Crab, *Hymenicus varius;* Fresh-water Shells, *Potamopyrgus coralla*, *P. antipodum*, *P. cumingiana*, *P. pupoides*, *Latia neritoides;* Fresh-water Sponge, *Spongilla* (sp.?), fine large specimens from Lake Takapuna, Auckland; Pteropod, *Cavolina affinis.*

Mr. David G. Stead exhibited a portion of a hardwood wharf-pile, bored by the *Teredo* or "Ship-worm," which had been excavated from Lower Pitt-street during the recent sewerage operations at a depth of about 12ft. Although the pile must have been embedded in the mud for a great number of years, it was in an excellent state of preservation. He also showed the ova of a large Australian Crayfish (*Astacopsis serratus*, Shaw), and of *Ibacus peronii*, a somewhat uncommon crustacean, from

Port Jackson. Also a specimen of the beautiful little *Octopus pictus*, which frequents rock-pools along our shores.

Mr. Walter R. Harper exhibited several Australian ethnological specimens, including :—(1) A roll of string made from human hair; (2) a belt in the manufacture of which this hair is used; (3) an initiation bull-roarer with the string of human hair; (4) a leader's badge used in ceremonial dances, composed of emu feathers, human hair, opossum fur, &c.; (5) a pubic tassel made from opossum fur and brigalow bark; (6) a necklet of eucalypt opercula, all from the Diamantina River.

Mr. W. W. Froggatt exhibited a collection of Lac-producing Coccids of the genus *Tachardia*, containing all the Australian species except one, and all the foreign species except three. Also several undetermined native species, among them several probably new. The lac insects are well known in commerce, as from *Tachardia lacca* of India 25,000 tons of lac are collected in India alone. The tests of the sexes are very distinct; those of the males are slender, thin and turned up at the apices, where the opening is covered with a thin plate. The female surrounds herself with a mass more or less rounded, in the centre of which she remains glued to the bark. Without legs or antennæ, she is provided with two curious tubes on the dorsal surface known as the lac tubes.

Mr. Percy Williams exhibited a large specimen of a "Funeral Stone" from Wilcannia, together with a drawing of the same. The characters and lines were described, and the exhibitor propounded a theory that it was probably an historical record of a Chief or King of a tribe, or of a tribe itself.

Mr. E. G. W. Palmer exhibited a peculiarly twisted, intertwined and plaited scrub vine or supplejack from a gully at Lawson, Blue Mountains. He also drew attention to a paragraph in the *Herald* of Aug. 23rd, describing a shower of small fish* near Warwick, Queensland, and the capture of a strange fish at Sandringham.

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* According to a notice in the same Journal for January 7th, 1902, specimens were submitted to the Department of Fisheries by Dr. Phillips of Warwick, and identified as *Ophiorrhinus grandiceps*.—Ed.

Mr. G. A. Waterhouse exhibited specimens of Rhopalocera, viz.:—*Liphyra brassolis*, Westw., *Casyapa beata*, Hew., *Mynes geoffroyi*, Bois.

Mr. Greig Smith exhibited some apparatus and appliances used in bacteriological work. Among the exhibits were an automatic pipette, wire filter stands, and an improved test-tube stand. A culture of the bacterium of blue milk, *Bacterium cyanogenes*, and specimens of mannite from wine, were also shown. The Stutzer rubber valve stopper was exhibited and compared with the Soxhlet rubber stopper.

WEDNESDAY, SEPTEMBER 25TH.

The Ordinary Monthly Meeting of the Society was held in the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, September 25th, 1901.

Mr. J. H. Maiden, F.L.S., &c., President, in the Chair.

The President announced that Mr. P. N. Trebeck had resigned the office of Hon. Treasurer in consequence of his retirement from active business life; also that the Council had regretfully accepted Mr. Trebeck's resignation, and had appointed Mr. James R. Garland, M.A., of 56 Elizabeth Street, to be Hon. Treasurer in succession to Mr. Trebeck. Mr. Garland assumed office on the 5th inst.

The President also formally announced the death of Professor Ralph Tate, F.L.S., F.G.S., of the University of Adelaide, a Corresponding Member of the Society, on 20th inst.; and made appreciative reference to Professor Tate's unflagging interest in and efforts towards the advancement of science in Australia, and especially in the State of South Australia, where he had resided since the year 1875. It was resolved that a letter expressive of the Society's regret and sympathy should be forwarded to Mrs. Tate and family.

DONATIONS.

Department of Agriculture, Brisbane—Queensland Agricultural Journal. Vol. ix. Part 3 (September, 1901). *From the Hon. the Secretary for Agriculture.*

Twelve Entomological Separates (from the Queensland Agricultural Journal. Vols. i.-vii., 1898-1900). By H. Tryon, Department of Agriculture, Brisbane. *From the Author.*

Australian Museum, Sydney—Records. Vol. iv. No. 4 (August, 1901). *From the Trustees.*

Census of New South Wales, 1901—Bulletin, Nos. 1-2. *From the Government Statistician, Sydney.*

Department of Mines and Agriculture, Sydney. Agricultural Gazette of New South Wales. Vol. xii. Part 9 (September, 1901). *From the Hon. the Minister for Mines and Agriculture.*

One Separate from the Agricultural Gazette of N.S.W., August, 1900 (Miscellaneous Publication, No. 405). By W. W. Froggatt, F.L.S., Government Entomologist. *From the Author.*

Public Library of New South Wales, Sydney—Annual Report of the Trustees for the Year 1901. *From the Trustees.*

Royal Anthropological Society of Australasia, Sydney—Science of Man. Vol. iv. n.s. No. 7 (August, 1901). *From the Society.*

Royal Society of New South Wales, Sydney—Abstract of Proceedings, September 4th, 1901. *From the Society.*

Australasian Institute of Mining Engineers, Melbourne—Proceedings. Special General Meeting, July 26th, 1901; First Ordinary Meeting, 1901: List of Members, &c. *From the Institute.*

Australasian Journal of Pharmacy, Melbourne. Vol. xvi. Nos. 188-189 (August-September, 1901). *From the Editor.*

Department of Agriculture, Victoria—Annual Report for the Year 1899 (1900). *From the Government Entomologist.*

Field Naturalists' Club of Victoria, Melbourne—Victorian Naturalist. Vol. xviii. No. 5 (September, 1901). *From the Club.*

Gordon Technical College, Geelong—Annual Report for 1900. *From the Registrar.*

Department of Mines, Hobart—Progress of the Mineral Industry of Tasmania for the Quarter ending 30th June, 1901. *From the Secretary for Mines.*

Department of Agriculture, Perth, W.A.—Journal. Vol. iv. Part 2 (August, 1901). *From the Secretary.*

Royal Society of South Australia, Adelaide—Transactions. Vol. xxv. Part 1 (August, 1901). *From the Society.*

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One Pamphlet "Informe Preliminar sobre El Rio Santa Cruz, El Lago Argentino, &c." (4to.; Buenos Aires, 1900); and one Separate (R. Accad. d. Lincei (5), x., 1901). By F. Silvestri. *From T. Steel, Esq., F.L.S., F.C.S.*

ARACHNIDA FROM THE SOUTH SEAS.

By W. J. Rainbow, F.L.S., F.E.S.

(Entomologist to the Australian Museum.)

(Plate xxviii.)

Some months ago Mr. J. J. Walker, R.N., F.L.S., F.E.S., kindly handed me a collection of Arachnida for examination and determination. The specimens were collected by that gentleman during the island cruise of H.M.S. Ringarooma in the months of June, July, August and September, 1900. Unfortunately my study of the forms obtained was interrupted by illness, and the publication of the results of Mr. Walker's labours delayed.

In all Mr. Walker collected upon the various islands visited thirty-four species, and these, with descriptions of new forms, are enumerated below. It will be seen from a perusal of the list that, with one exception, there is nothing but what one might have expected. Some of the forms are common and widely distributed.

Order ARACHNIDA.

Suborder Scorpionidæ.

Family PANDINOIDÆ.

Genus Hormurus., Thor.

1. Hormurus australasiæ, Fab.

Loc.—Malekula, New Hebrides.

Common in the South Sea Islands.

Suborder Opilionidæ.

Section II.—OPILIONES LANIATORES, Thor.

Family TRIÆNONYCHOIDÆ.

Genus Triænonyx, Sör.

2. (?) Triænonyx rapax, Sör.

Loc.—Noumea, New Caledonia.

Only one specimen, and that immature, was collected. I have some doubt as to whether this is really Sörensen's E. rupex. From the fact that the specimen obtained is immature, it is not safe to speak with certainty, hence its present location is only tentative. E. rupex is the type both of its family and genus, and was originally recorded from the Island of Viti.*

Suborder Araneæ Veræ.

Family ULOBORIDÆ.

Genus Uloborus, Latr.

3. Uloborus geniculatus, Oliv.

Loc.—Malekula, New Hebrides.

This is a widely distributed species occurring in nearly all tropical regions.

Family DRASSIDÆ.

Subfamily DRASSINÆ.

Genus Leptodrassus, E. Sim.

Amongst the species collected by Mr. Walker there is one which apparently belongs to the genus *Leptodrassus*. This is [illegible]. According to Simon,† "Le genre *Leptodrassus* [illegible] méditerranéenne et une dans [illegible] mais ce genre [illegible] Afrique occidentale et australe et [illegible] Amérique du Sud par les espèces [illegible]" [illegible] his diagnosis of the genus [illegible] Europa max. austr.; Africa [illegible] Asia [illegible] so that the occurrence of the genus on the Island of Malekula, in the New Hebrides, is interesting. At first I was somewhat doubtful as to the systematic position of the form under consideration, but a careful comparison of the Araneid with Simon's definition of the genus *Leptodrassus*, and also with his figure,* convinced me there could be little doubt as to the correctness of my determination.

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* Sorensen, Die Arach. Aust. ii. 1886 (Supplement), pp. 57-59, tab. 5, fig. 2.

† Simon, Hist. Nat. des Araign. (2nd ed.), 1893, Vol. i., p. 358.

‡ *Loc. cit.*, p. 364.

4. LEPTODRASSUS INSULANUS, sp.nov.

(Plate xxviii., figs. 1, 1*a*.)

♂. Cephalothorax 3·3 mm. long, 2·4 mm. wide; abdomen 4·4 mm. long, 2·2 mm. wide.

Cephalothorax obovate, longer than wide, arched, mahogany-brown, moderately pubescent. *Pars cephalica* strongly arched, normal grooves distinct. *Pars thoracica* broad, arched, radial and median longitudinal grooves distinct.

Eyes in three series of 2, 4, 2. The median anterior pair are very much the largest of the group, and are separated from each other by less than half their individual diameter; posterior median pair are separated from their anterior neighbours by a space equal to once their individual diameter, and from each other by about one and one-half diameters; lateral eyes oblique, oval, and nearly contiguous.

Legs concolorous with cephalothorax, long, slender, moderately hairy, and armed with long, strong spines. Relative lengths 1, 4, 2, 3.

Palpi long, similar in colour and armature to legs; copulatory organ as in figure.

Falces concolorous with cephalothorax, hairy, arched.

Maxillæ concolorous, long, arched, apices inclining inwards.

Labium concolorous also, short, not much longer than broad, truncated.

Sternum somewhat paler in colour than the foregoing, shield-shaped, arched.

Abdomen oblong-ovate, arched, moderately overhanging base of cephalothorax, pubescent; superior surface and sides dirty yellowish-brown, inferior surface yellowish.

Loc.—Malekula, New Hebrides.

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* *Loc. cit.*, p. 355, fig. 323.

Family THERIDIIDÆ.

Genus ARGYRODES, E. Sim.

5. **ARGYRODES ANTIPODIANA**, Camb.

Loc.—Noumea, New Caledonia.

Mr. Walker collected three specimens at Noumea of a species which appears, when compared with our native forms, inseparable from *A. antipodiana.* This species also occurs in New Zealand.

6. **ARGYRODES WALKERI**, sp.nov.

(Plate xxviii., figs. 2, 2*a*, 3, 3*a*.)

♂. Cephalothorax 1·5mm. long, 1·3mm. broad; abdomen 2mm. long, 1·2 mm. broad.

Cephalothorax orange-yellow, smooth, glossy. *Pars cephalica* produced and elevated, and divided in front by a transverse cleft into two lobes, of which the upper is much the largest, and these, excepting at the base of the cleft, touch each other; the lower lobe is clothed with short, stiff black hairs. *Pars thoracica* broad, arched, normal radial grooves distinct.

Eyes normal.

Legs long, tapering, orange-yellow except at joints, which have dark brown annulations, and clothed with short black hairs. Relative lengths: 1, 2, 4, 3, those of the first pair being much the longest.

Palpi long, slender, orange-yellow; copulatory organ as in figure.

Falces yellow, glossy, long, moderately strong, arched.

Maxillæ, *labium* and *sternum* concolorous, normal.

Abdomen yellowish, oblong, uneven, gradually ascending from its base to posterior extremity, where it is produced into a somewhat cylindrical prominence, the apex of which is slightly depressed, and relieved by a large dark brown spot, the latter thinly clothed with a few short black hairs.

♀. Cephalothorax 2mm. long, 1·4mm. broad; abdomen 3·2mm. long, 2·6 mm. broad; height (from spinners to highest point) 3·3 mm.

Cephalothorax orange-yellow, smooth, glossy. *Pars cephalica* arched, elevated in front, but not bilobed. *Pars thoracica* arched, broad, normal grooves distinct.

Eyes normal.

Legs long, slender, tapering, hairy; coxæ and trochanters orange-yellow, thence dark brown, except in the fourth pair, which have the tarsi orange-yellow. Relative lengths: 1, 2, 4, 3, and of these the first pair is, as usual, the longest.

Palpi short, hairy, orange-yellow.

Falces, maxillæ, labium and *sternum* concolorous, normal.

Abdomen finely pubescent, arched, short, the height distinctly greater than the length; from the base, which is low, it ascends boldly until it terminates in a somewhat conical and obtuse point. Its general colour is clay-yellow, relieved on the upper surface with four large dark brown spots, arranged in rows of two each; of these the first pair is seated at a little more than one-third the space from the base, and the second pair by an equal distance from the apex at the posterior extremity; sides and inferior surface clay-yellow with dark brown markings.

Epigyne as in figure.

Loc.—Torres Island, between New Hebrides and Santa Cruz Groups.

Mr. Walker succeeded in securing three specimens of the species herein described—one male and two females. Simon has recorded from Malekula, New Hebrides, *A. miniatus* of Doleschall; and from New Caledonia, *A. sublimis*, L. Koch.* The latter was originally recorded from the island of Upolu, but it also occurs in Australia. The previously recorded species from Australia and the South Sea Islands are :—*A. samoensis*, Camb., Samoa; *A. antipodiana*, Camb., Australia and New Zealand; *A. sublimis*, L. Koch, Upolu; *A. gracilis*, L. Koch, Upolu; *A. malleiformis*, L. Koch, Upolu; *A. incisifrons*, Keys., Bowen and Sydney; *A. miniatus*, Dolesch., found in all tropical regions. The species described by me† as *Theridion margaritarium* is also an *Argyrodes*

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* Simon, Ann. de la Soc. Entom. France, 1897, p. 272.

† P. L.S.N.S.W., Vol. viii. (2nd Series), 1893, p. 290, pl. x., figs. 3, 3*a*, 3*b*, 3*c*.

(*A. margaritarius*), and this was collected by Mr. A. M. Lea, F.E.S., at the Clarence River, N.S. Wales.

Genus THERIDION, Walck.

7. (?) THERIDION LUDICUS, E. Sim.

Loc.—Noumea, New Caledonia.

Only one specimen, and that immature, was procured by Mr. Walker. Simon recorded this species from the Isle of Pines.

Genus LATRODECTUS, Walck.

8. LATRODECTUS HASSELTII, Thor.

Loc.—Chepenehe, Lifu, Loyalty Islands; Noumea, New Caledonia.

Widely distributed throughout Australia, New Zealand, Polynesia, Papua, Malaysia and India.

Family ARGIOPIDÆ.

Subfamily TETRAGNATHINÆ.

Genus TETRAGNATHA, Latr.

9. TETRAGNATHA PANOPEA, L. Koch.

Loc.—Tanna and Malekula, New Hebrides; Noumea, New Caledonia.

Originally recorded by Koch from Samoa, and later by Simon from Mallicolo, New Hebrides.*

Genus ARGYROEPEIRA, Emer.

10. ARGYROEPEIRA GRATA, Guér.

Loc.—Tanna and Aneityum, New Hebrides.

This species is widely distributed, having been recorded from Halmahera, Amboina, Ceram, Aru, New Guinea and New Britain.†

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* Simon, *loc. cit.*, p. 272.

† Pocock, Zoological Results, based on material from New Britain, New Guinea, Loyalty Islands, and elsewhere. Part i., 1898, p. 104.

11. **A. CELEBESIANA**, Walck.

Loc.—Torres Islands, between New Hebrides and Santa Cruz Groups.

Widely distributed, occurring in Burma, Malaysia, Papua, Australia, and South Pacific Islands.

Subfamily NEPHILINÆ.

Genus NEPHILA, Leach.

12. **NEPHILA MACULATA**, Fab.

Loc.—Tanna, New Hebrides.

Widely distributed, ranging from Burma eastward to the South Pacific.

Subfamily ARGIOPINÆ.

Genus ARGYOPE, Aud. & Sav.

13. **ARGYOPE PICTA**, L. Koch.

Loc.—Malekula, New Hebrides.

Originally recorded from Port Mackay, Queensland; also from Tamata Station, Mambare River, Neneba, New Guinea, and New Britain.

14. **A. PLANA**, L. Koch.

Loc.—Malekula, New Hebrides; Noumea, New Caledonia.

Previously recorded from Australia, Viti, Ovalau, and Tonga.

Genus CYRTOPHORA, E. Sim.

15. **CYRTOPHORA MOLUCCENSIS**, Dolesch.

Loc.—Aneityum, New Hebrides.

Widely distributed over India, Ceylon, Malaysia, Papua, and South Sea Islands.

Genus ARANEUS, Clerck (= *Epeira* auct.).

16. **ARANEUS THEISII**, Walck.

Loc.—Tanna, Malekula and Aneityum, New Hebrides; Noumea, New Caledonia.

17. A. nauticus, L. Koch.

Loc.—Noumea, New Caledonia.

This, and the preceding species, are common in tropical regions.

Genus Gasteracantha, Sund.

18. Gasteracantha mollusca, L. Koch.

Loc.—Noumea, New Caledonia.

Originally recorded from Port de France, Noumea, and later, by me, from British New Guinea.*

Family THOMISIDÆ.

Subfamily MISUMENINÆ.

Genus Diæa, Thor.

19. Diæa bipunctata, sp.nov.

(Plate xxviii., figs. 4, 4*a*.)

♀. Cephalothorax 2 mm. long, 1·9 mm. broad; abdomen 3·7 mm. long, 2·5 mm. broad.

Cephalothorax pale yellowish, smooth, glossy, nearly as broad as long, arched. *Pars cephalica*, broad, arched. *Pars thoracica* broad, arched, radial grooves very faint.

Eyes normal, black, each mounted upon a small, bluish-grey tubercle.

Legs concolorous with cephalothorax, finely pubescent, and armed with spines; of the latter those upon the tibiæ and metatarsi of the first and second pairs are much the longest and strongest. Relative lengths 1, 2, 4, 3.

Palpi short, similar in colour to legs, and armed with short spines.

Falces concolorous, short, strong, arched.

Maxillæ concolorous also, long, narrow, arched, apices inclining inwards.

Labium concolorous, long, coniform.

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* Rec. Aust. Mus., Vol. iii., Part 5, p. 112.

Sternum concolorous also, shield-shaped, truncated in front, gently arched, smooth.

Abdomen ovate, slightly projecting over base of cephalothorax, arched, cream-yellow, finely reticulated. Near anterior extremity a short, broad, median, longitudinal band of yellowish-grey commences, and this terminates near the centre; the band is irregular in outline, and has short, strong lateral projections from whence a scheme of delicate tracery proceeds, the latter being observable only by the aid of a lens; close to the posterior extremity of this longitudinal bar there is on each side of it a large, dark spot or depression; the sides cream-yellow, reticulated, inferior surface yellowish-brown, relieved by a few small spots of cream-yellow.

Epigyne as in figure.

Loc.—Aneityum, New Hebrides.

20. DIÆA REGALIS, sp.nov.

(Plate xxviii., figs. 5, 5*a*.)

♀. Cephalothorax 1·8 mm. long, 1·3 mm. broad; abdomen 2·8 mm. long, 2·2 mm. broad.

Cephalothorax and *eyes* as in *D. bipunctata.*

Legs pale yellowish, finely pubescent; tibiæ and metatarsi of first and second pairs armed with long, strong spines. Relative lengths: 1, 2, 4, 3.

Palpi short, concolorous, finely pubescent, and armed with short spines.

Falces, maxillæ and *labium* concolorous also; normal.

Sternum glossy, gently arched, shield-shaped, truncated in front, finely pubescent, pale yellowish.

Abdomen obovate, slightly projecting over base of cephalothorax, arched, yellow-brown, encircled by a broad finely reticulated cream-yellow band; the superior surface is ornamented with a long, broad, sinuous, finely reticulated cream-yellow design, and this is bisected at its anterior and broadest part; sides yellow-brown with cream-yellow spots; inferior surface yellow-brown.

Loc.—Malekula, New Hebrides.

Family CLUBIONIDÆ.

Subfamily SPARASSINÆ.

Genus HETEROPODA, Latr.

21. **HETEROPODA VENATORIA, Linn.**

A number of specimens of this common spider were collected by Mr. Walker.

Loc.—Tanna, Malekula and Aneityum, New Hebrides; Noumea, New Caledonia.

Genus PRYCHIA, L. Koch.

22. **PRYCHIA GRACILIS, L. Koch.**

Loc.—Torres Islands; Malekula and Aneityum, New Hebrides.

Previously recorded from the islands of Viti and the New Hebrides.

Subfamily CLUBIONINÆ.

Genus CHIRACANTHIUM, C. Koch.

23. **CHIRACANTHIUM LONGIMANUM, L. Koch.**

Loc.—Tanna, New Hebrides.

24. **CHIRACANTHIUM GILVUM, L. Koch.**

Loc.—Malekula, New Hebrides.

Both species are common in Queensland and the South Pacific Islands.

Family LYCOSIDÆ.

Genus LYCOSA, Latr.

25. LYCOSA CŒNOSA, mihi.

Loc.—Tanna and Malekula, New Hebrides; Chepenehe, Lifu, and Loyalty Islands.

Previously recorded from the island of Santa Cruz.

26. (?) LYCOSA PALABUNDA, L. Koch.

Loc.—Noumea, New Caledonia.

Only one specimen, and that immature. *L. palabunda* has been recorded from Sydney, Gayndah and Rockhampton, and also from the South Sea Islands.

Family ATTIDÆ.

Genus MARPTUSA, Thorell.

27. **Marptusa complanata**, L. Koch.

Loc.—Noumea, New Caledonia.

Previously recorded from Rockhampton, Gayndah and Port Mackay.

28. **Marptusa melanognathus**, Lucas.

Loc.—Noumea, New Caledonia.

This species is cosmopolitan.

Genus BAVIA, E. Sim.

29. **Bavia dulcinervis**, L. Koch.

Loc.—Torres Island.

Originally recorded from Pelew Island.

Genus MARENGO, Peckh.

30. **Marengo bilineata**, Peckh.

Loc.—Tanna, New Hebrides.

Genus HASARIUS, E. Simon.

31. **Hasarius garetti**, L. Koch.

Loc.—Malekula, New Hebrides.

Originally recorded from Ragatea.

32. **Hasaris diloris**, L. Koch.

Loc.—Noumea, New Caledonia.

Previously recorded from Port Mackay, Queensland, and Viti Island.

Genus JOTUS, L. Koch.

33. **Jotus arci-pluvii**, Peckh.

Loc. —Tanna and Malekula, New Hebrides.

Originally recorded from the Island of Santa Cruz.

Genus PLEXIPPUS, C. Koch.

34. **Plexippus paykulli**, Aud.

Loc.—Malekula, New Hebrides.

This species is cosmopolitan.

EXPLANATION OF PLATE XXVIII.

Fig. 1 .—*Leptodrassus insulanus*, eyes.
Fig. 1*a*.— ,, ,, copulatory organ.
Fig. 2 .—*Argyrodes walkeri* (♂) in profile.
Fig. 2*a*.— ,, ,, (♂) copulatory organ.
Fig. 3 .— ,, ,, (♀) in profile.
Fig. 3*a*.— ,, ,, epigyne.
Fig. 4 .—*Diæa bipunctata* (♀).
Fig. 4*a*.— ,, ,, epigyne
Fig. 5 .—*Diæa regalis* (♀).

THE SYSTEMATIC POSITION OF *PURPURA TRITONIFORMIS* OF BLAINVILLE.

By H. Leighton Kesteven.

(Plate xxix.)

A good deal of doubt has existed as to the systematic position of the mollusc under discussion. It was first described as a *Purpura* by Blainville.* Kiener† placed it in the same genus in his second section *Semi-ricinules.* Dunker‡ described it as *Adamsia typica*, classing it with *Cominella.* Tenison-Woods§ subsequently showed that *Adamsia* was preoccupied by Prof. E. Forbes, and replaced it by *Agnewia.* Tryon,|| who next dealt with it, transferred the species to *Urosalpynx* on the strength of its purpuroid operculum. His synonymy of it embraced *Adamsia typica*, Dkr., *A. adelaidæ*, Ad. & Ang., and *Purpura neglecta*, Angas, the last two as possible varieties. No one acquainted with *P. neglecta* in Sydney Harbour would agree that it conforms either generically or specifically with *P. tritoniformis.* The validity of *A. adelaidæ* is maintained by Dr. Verco.¶

Watson,** practically ignoring Woods's correction, re-instated *Adamsia* as a subgenus of *Cominella.* The operculum, which Angas†† had previously stated to be purpuroid, he considered evidence for, rather than against, this classification. The species is omitted from the Conchologica Iconica, the Conchlyien Cabinet, and the Thesaurus Conchyliorum.

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* Nouv. Ann. du Mus. d'Hist. Nat. Tome i. p. 221, pl. 10, fig. 10, 1833.

† Coq. Viv. Purpurifère, i., pl. 8, fig. 18.

‡ Proc. Zool. Soc. 1856.

§ Proc. Roy. Soc. Tasmania for 1877.

|| Man. Conch. Vol. ii., 1880, p. 156.

¶ Trans. Roy. Soc. S. Aust., 1895, Vol. xix., p. 101.

** Chall. Rep. Zool. Vol. xv., Gasteropoda, 1885, p. 214.

†† Proc. Zool. Soc. 1867, p. 192.

After a careful study of the shell, its apex, the operculum, and the mollusc itself, I have come to the conclusion that its right place is in the genus *Purpura*, where it was first assigned.

There are three varieties of the shell: firstly, the typical; secondly, a stouter form confined to Lord Howe Island; thirdly, a lighter form.

The form selected as typical is of course that figured by Blainville. Kiener's illustration seems a copy (too highly coloured) of Blainville's. This aspect of the species is the commonest on the coast of New South Wales; it also occurs at Lord Howe Island.

P. TRITONIFORMIS, var. SMITHI, Brazier.

Purpura Smithi, Braz., Aust. Mus. Mem. No. ii. Lord Howe Island, p. 28, pl. ii., figs. 1-4, 7-12, 21, 22.

Heavier, shorter and stouter than the type; spire shorter. Sculpture: body whorl—spirals coarser than in the type, being raised into stout cord-like ribs; longitudinals, consisting of coarse hair lines, most prominent between the ribs, making the interstices scabrous: spire—spiral ribs ornamented with nodules, as broad as their interstices, in transverse oblique rows; the longitudinal scabrous hair-lines gathered together between these nodules to form riblets which tend to give the spire a latticed appearance. Aperture smaller than in the type, the revolving liræ within more prominent. Length 17-25, breadth 6-14 mm.

This variety seems to be confined to Lord Howe Island.

The name was given to it by Brazier in 1889, without a description, and the figures of it then published were unfortunately reversed in the press.

P. TRITONIFORMIS, var. LEVIDENSIS, var. nov.

Lighter than the type, but of the same outline. Sculpture—spirals consisting of a multitude of fine lines overlying four or five obsolescent broad low rounded ribs; longitudinals, eleven to fifteen low rounded ribs slightly broader than their interstices traverse the whorls, between which and the revolving ribs may be seen the longitudinal scabrous hair-lines. Aperture rounder and larger than in the type, due to the absence of a porcellanous thickening on the interior of the outer lip. The revolving liræ in the aperture are finer, more numerous, and stained dark brown. Proportions as in the type.

Hab.—New South Wales and Lord Howe Island.

Type to be presented to the Australian Museum.

The purpuroid characters of the adult shell are in the aperture. The columellar area is broad and flattened, and the thickened and lirate outer lip is decidedly characteristic of the genus *Purpura*. The sculpture of var. *smithi* is not unlike (in miniature) that of *P. succincta*, Martyn.

Several apices of the same type as that of *P. tritoniformis* have been treated as adult mollusca, and as their history bears directly on the conclusions I have arrived at, I give the following résumé of it.

The first of these was described by Gray* as *Struthiolaria microscopica*. The second is that described by D'Orbigny† as *Sinusigera cancellata*. The third is *Cheletropis huxleyi* of Forbes.‡ Others were meagrely described by A. Adams in various papers in the Annals and Magazine of Natural History, and others again by Craven§ in his Monograph of the genus *Sinusigera*. The principal conchological feature of the three mentioned was the possession of claw-like lobes on the outer lip, such as are so plainly shown by my fig. 4.

Dr. J. D. Macdonald|| pointed out the anatomical similarity of *Sinusigera* (*Cheletropis*) *huxleyi* to *Macgillivrayia pelagica*, Forbes (*loc. cit.* p. 383), another pelagic gasteropod embryo; and, being under the impression that they were adult molluscs, suggested that they should be placed in an order by themselves. A. Adams¶ wrote that the genus *Sinusigera* belonged to the *Macgillivrayidæ*,

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* Zool. Voy. Blossom, 1839, p. 108.

† Hist. Pol. y Nat. de Cuba, 1846, Moll. Vol. v., p. 241.

‡ Voy. Rattlesnake, 1852, Vol. ii. Append. 385, pl. iii., figs. 9 *a* and *b*.

§ Ann. Soc. Mal. Belgique, 1877, Vol. xii.

|| Phil. Trans. 1854, Vol. 145, pp. 289-297.

¶ Ann. Mag. Nat. Hist., June, 1857, p. 461.

and proposed the suborder *Brachiocephala* for the reception of the family. In the first volume of their "Genera of Recent Mollusca" (p. 60, 1853), the brothers Adams placed the genus *Sinusigera* among the Pteropoda, but in the second volume (1858, p. 613) as a result of Dr. Macdonald's article they placed it among the Heteropoda in their family *Macgillivrayidæ*.

The first to realise that *Sinusigera* was an embryonic and not an adult mollusc was Dr. J. D. Macdonald,[*] in 1858, and he gave his reasons for supposing one he had found to be the pullus of a Pedicularia.

As the apex of the Pedicularia he figured shows at least two smooth and three cancellated whorls, and the pullus shows only one cancellated whorl, and as there is also a difference of contour, we may be allowed to doubt the correctness of his conclusions till further proof is forthcoming. Dautzenberg[†] figures the apex of a Pedicularia, but he does not mention any Sinusigera-characters. Further, it might be well to notice that Macdonald's pullus, which is very similar to the one I figure, came from about the same locality.

This note of Macdonald's, although it sowed the seeds of doubt, did not settle the matter conclusively, for A. Adams described several subsequent to its appearance, and Craven's monograph, in which he described new species, was published in 1877. The latter considered the constancy of shape and size of each species proof of the stability of the genus.

Jousseaume,[‡] in a "Note sur le devéloppement des coquilles," says that Mons. Calamle, of Benguela, had found that the embryonic whorls of *P. hæmastoma*, Linn., show all the characters of a Sinusigera. Craven[§] figures a young stage in the growth of a Purpura showing the Sinusigera-character of the pullus; this he believes is *P. hæmastoma*, and remarks that the pullus is very similar to *S. cancellata*, D'Orb. Crosse[||] republished his figures, and confirmed his conclusions. Dautzenberg also figured a young stage of *P. hæmastoma* showing the same characters.[*] This figure was copied by Simroth in Bronn's Klass. u. Ord. (Band iii., 1899, taf. xxi., fig. 9).

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[*] Trans. Linn. Soc. Lond. Vol. xxii. p. 241.

[†] Result. Camp. Scien. de Prince de Monaco. Fasc. i., pl. iv., figs. 2*a*-2*b*.

[‡] Le Naturaliste, 1882, p. 183.

[§] Ann. Mag. Nat. Hist. 1883, p. 141.

According to Tryon (*loc. cit.*, p. 52), A. Adams has referred a Sinusigera to *P. biseralis*, Blainv.

Figure 1 of Plate xxix., shows the Sinusigera-character of the apex of *P. succincta*, Martyn. Figures 2-3 represent different stages in the early growth of *P. tritoniformis*, and show plainly that this species also has an apex of the Sinusigera-type. That *P. tritoniformis* has an apex of this type was first noticed by Mr. A. U. Henn (Proc. Linn. Soc. N.S.W. (2) Vol. ix. 1894, p. 167)

Figure 4 represents a detached pullus of this type obtained in the towing-net 360 miles north-east of Sydney; a similar pullus was dredged by Brazier in Vaucluse Bay, Port Jackson. This may be the embryo of *P. tritoniformis*, but so great is the resemblance between the apex of that species and that of *P. succincta* that at present it is impossible to tell to which species the specimen figured belongs. It is probable that in the embryonic stage they are exactly similar. The little shell answers well to Forbes' description and figure of *Cheletropis huxleyi*, but in view of the similarity mentioned above I refrain from saying definitely that it is that species.

We cannot yet decide on the value of the apex for classificatory purposes, but since the only three embryos of this extraordinary type that have been followed to their later stages have proved to be those of *Purpura*, such an apex may surely be taken as a guide to the generic position.

It has occurred to me that the tooth of *Monoceras* may possibly be a perpetuation of the lower Sinusigera-lobe. It would be interesting to know whether the species of that genus have an apex of the type.

I do not expect the embryo of every Purpura to be of the Sinusigera-type, but every embryo of the type to be that of a Purpura.

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[*] *Loc. cit.*, p. 38, pl. ii., fig. 5.

By "Sinusigera-type" I mean an embryo bearing on its outer lip the claw-like processes and consequent sinus so noticeable in all the examples mentioned. I know that Dall* has proposed the name *Sinusigera* for cancellated apices of the *Pleurotomidæ;* but with all deference to one so much my senior I would suggest that the term were better restricted to such as I mention above.

The operculum, as Angas said, is purpuroid; the nucleus is placed in the middle of the outer edge. The inner surface is finely striated.

The mollusc itself so closely resembles *P. succincta* that but for the lingual ribbon it would be almost impossible for the dissector to tell whether he were working on the young of that species or an adult *P. tritoniformis.* The two dentitions are represented in figs. 5-6 of Plate xxix. It will be observed that the difference between these two radulæ is one of degree rather than of kind.

Summary.—In the preceding pages reasons are given for removing *P. tritoniformis* from *Urosalpinx* and *Cominella* and transferring it to *Purpura.* It remains to select a subgenus of the latter for its reception. By the form of the shell *Polytropa* might claim it, but the resemblance of the larval shell and of anatomical characters to *P. succincta* is so close that *Trochia* would seem more appropriate.

The names *Adamsia* and *Agnewia* consequently lapse into the synonomy of *Trochia.*

EXPLANATION OF PLATE XXIX.

Fig. 1.—Young of *Purpura succincta*, Martyn; length 2·3 mm.
Fig. 2.—Young of *Purpura tritoniforimis*, Blainv.; length 3 mm.
Fig. 3.— ,, ,, ,, ,, ,, 5 ,,
Fig. 4.—An embryo of the Sinusigera-type; length 2, breadth 1·3 mm.
Fig. 5.—Dentition of *Purpura tritoniformis.*
Fig. 6.— ,, ,, *succincta.*
Fig. 7.—Operculum of *Purpura tritoniformis* (adult); 10·5 × 6·5 mm.
Fig. 8.—Operculum of *Purpura succincta* (young); 18·12 mm.

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* Blake Moll. Vol. ii., p. 124.

NOTES AND EXHIBITS.

Mr. Froggatt exhibited specimens of the two sexes of the large spiny phasmid, *Extatosoma tiaratum*, Macl. The female is not uncommon in the coastal scrubs, but the male is comparatively rare.

Mr. Harper contributed a supplementary Note on the "Onvar" or wrist-guard of Malekula. "After my paper (*antea*, p. 233) was read, I obtained further information from Rev. T. Watt Leggatt, of Malekula. The same spiral band mentioned as being used in the islands to the north is also common in Malekula, together with a simpler form, consisting merely of the mid-rib of a banana leaf twisted round the wrist. The form figured is worn loosely as a rule; but when fighting is imminent it is laced tightly with a grass fibre. Further, Mr. Leggatt has investigated the name usually given for the guard, viz., '*onvar*.' He discovers that the correct title in the Aulua district (Port Sandwich) is *nehonvar*, derived from *nehono*, the face, and *verna*, the hand—*ver* or *var* being the root for hand, as *verangk*, my hand; *verim*, thy hand; *verna*, his hand. The word really means the face of the hand, *i.e.*, the thing that stands before the hand to protect it. In the Maskelyne Group, south of Malekula, the guard is called *nahonva*. In Pangkumu it is named as at Aulua. In the Uripio district the word used is *bekver*, the derivation of which Mr. Leggatt has not been able to discover." [The matter here given in its proper place, was also printed on a slip and inserted to face p. 236 of Part 2 of this Volume, for the sake of completeness.—Ed.].

Mr. Rainbow exhibited specimens of a common but interesting spider, *Desis marina*, O. P. Camb., from Port Jackson. This species is widely distributed, not only on the Australian coast generally, between tide-marks, but also in New Zealand and New Caledonia. In localities where *Lithodomus* occurs it is found occupying the disused holes of the latter; but in situations free from coral, the spider may be sought for under stones, in fissures, or in tunnels bored by such molluscs as *Venerupis* and *Pholas*, or, in fact, any natural cavity. The water is kept out of their dwellings by a curtain of thickly matted web. The abdomen of *Desis* is thickly coated with downy hairs, which entangling a quantity of air, and detaining it round the body during its immersion, gives to the spider when diving the appearance of a body covered with globules of quicksilver. Should the air within its chamber become exhausted, the spider returns to the surface and procures a fresh supply.

The President exhibited a double-flowered spathe of the common Arum lily, *Richardia africana*, Kth.; and a specimen of *Eucalyptus tereticornis*, Sm., from the Astrolable Range, New Guinea. Also, on behalf of Mr. E. Betche, who collected it, a spirit specimen of *Balanophora fungosa*, Forst., a root-parasite in dense, moist, coast forest, near Cairns, N. Queensland (August, 1901). It is, as far as known, the only representative in Australia of the interesting Order of *Balanophoreæ*, root-parasites of a more or less fungus-like habit, but belonging to the Dicotyledons, and allied to the *Olacineæ* and *Aristolochiaceæ*.

Mr. Fletcher exhibited copies of the two published books, and some interesting relics, of John William Lewin, "naturalist and painter," who settled in New South Wales in 1798; and whose remains until recently reposed in what was the Devonshire Street Cemetery. The exhibit included a few of Lewin's undoubtedly very numerous unpublished drawings; also early impressions of some of his published illustrations of birds and insects which were engraved, printed and coloured in the Colony; accompanying them are his MS. observations on the animals which served as the basis of the text which was printed in England: these are now in the possession of the Society. A sketch of Lewin's career as colonist, artist, zoological collector and field naturalist was given,

WEDNESDAY, OCTOBER 30TH, 1901.

The Ordinary Monthly Meeting of the Society was held in the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, October 30th, 1901.

Mr. J. H. Maiden, F.L.S., &c., President, in the Chair.

Mr. R. L. **Cherry**, Catherine Hill Bay, Newcastle, and Dr. J. H. **May**, Bundaberg, Q., were elected Ordinary Members of the Society.

DONATIONS.

Department of Agriculture, Brisbane—Queensland Agricultural Journal. Vol. ix. Part 4 (October, 1901). *From the Hon. the Secretary for Agriculture.*

Royal Geographical Society of Australasia, Queensland Branch,—Queensland Geographical Journal. Vol. xvi. (1900-1901). *From the Society.*

Botanical Gardens and Domains, Sydney—Report for the Year 1900 (1901). *From the Director.*

Department of Mines and Agriculture, Sydney—Agricultural Gazette of New South Wales. Vol. xii. Part 10 (October, 1901). *From the Hon. the Minister for Mines and Agriculture.*

Royal Anthropological Society of Australasia, Sydney—Science of Man. Vol. iv. n.s. Nos. 8-9 (September-October, 1901). *From the Society.*

Royal Society of New South Wales, Sydney—Abstract of Proceedings, October 2nd, 1901. *From the Society.*

The Surveyor, Sydney. Vol. xiv. No. 5 (October, 1901). *From the Editor.*

Australasian Journal of Pharmacy, Melbourne. Vol. xvi. No. 190 (October, 1901). *From the Editor.*

Australasian Ornithologists' Union, Melbourne—The Emu. Vol. i. Part 1 (October, 1901). *From the Union.*

Department of Mines, Melbourne—Report on Brown Coal from Narracan and from Dean's Marsh. By H. C. Jenkins, A.R.S.M., Government Metallurgist. *From the Secretary for Mines.*

Field Naturalists' Club of Victoria, Melbourne—Victorian Naturalist. Vol. xviii. No. 6 (October, 1901). *From the Club.*

Public Library, Museums, and National Gallery of Victoria, Melbourne—Report of the Trustees for 1900 (1901). *From the Trustees.*

Department of Mines, Hobart—Government Geologist's Report on the Tin Mining District of Ben Lomond (June, 1901): Assistant Government Geologist's Report on some Wolfram Sections near Pieman Heads (September, 1901). *From the Secretary for Mines.*

Department of Agriculture, Perth, W.A.—Journal. Vol. iv. Parts 3-4 (Sept.-Oct., 1901). *From the Secretary.*

British Museum (Nat. Hist.), London—Catalogue of the Mesozoic Plants in the Department of Geology. Part iii. (1900). By A. C. Seward, M.A., F.R.S., F.G.S.: Catalogue of Welwitsch's African Plants. Dicotyledons. Part iv. (1900); Vol. ii. Part 2. Cryptogamia (1901): Hand-List of the Genera and Species of Birds. Vol. ii. (1900). By R. B. Sharpe, LL.D.: Illustrations of the Botany of Captain Cook's Voyage Round the World in H.M.S. "Endeavour" in 1768-1771. By the Right Hon. Sir Joseph Banks, Bart., K.B., P.R.S., and Dr. D. Solander, F.R.S. With Determinations by James Britten, F.L.S. Part ii. Australian Plants (Folio; 1901). *From the Trustees.*

Manchester Literary and Philosophical Society—Memoirs and Proceedings. Vol. xlv. Part 4 (1900-1901). *From the Society.*

Royal Microscopical Society, London—Journal, 1901. Part 4 (August, 1901). *From the Society.*

Royal Society of London—Proceedings. Vol. lxviii. No. 449 (September, 1901). *From the Society.*

Zoological Society of London — Proceedings, 1901. Vol. i. Part 1 (June, 1901). *From the Society.*

Royal Irish Academy, Dublin—Proceedings. Third Series. Vol. vi. No. 2 (1901); Vol. vii. (1901). *From the Academy.*

Perak Government Gazette, Taiping. Vol. xiv. Nos. 26-27 (August-September, 1901). *From the Government Secretary.*

Canadian Institute, Toronto—Transactions. Vol. vii. Part 1 (No. 13; August, 1901). *From the Institute.*

Academy of Natural Sciences, Philadelphia—Proceedings. Vol. liii. Part i. (Jan.-March, 1901). *From the Academy.*

American Academy of Arts and Sciences, Boston—Proceedings. Vol. xxxvi. Nos. 24-28 (April, 1901). *From the Academy.*

American Museum of Natural History, New York—Annual Report for the Year 1900: Bulletin. Vol. xiv. Articles ix.-x. and xix., pp. 91-148 and 225-228 (May, 1901): Memoirs. Vol. i. Part 6 (March, 1901). *From the Museum.*

American Naturalist, Cambridge, U.S.A. Vol. xxxv. Nos. 416-417 (August-September, 1901). *From the Editor.*

Bureau of American Ethnology, Washington—Seventeenth Annual Report (1895-96). Part 2 (1898). *From the Director.*

Cincinnati Society of Natural History—Journal. Vol. xix. Nos. 7-8 (December, 1900-March, 1901). *From the Society.*

Denison University, Granville, Ohio—Bulletin of the Scientific Laboratories. Vol. xi. Article x., pp. 240-264 (February, 1901). *From the University.*

Johns Hopkins University, Baltimore—Hospital Bulletin. Vol. xii. Nos. 118-123 and 125 (January-August, 1901). *From the University.*

Museum of Comparative Zoology at Harvard College, Cambridge, Mass., U.S.A.—Bulletin. Vol. xxxvii. No. 3 (September, 1901). *From the Director.*

New York Academy of Sciences—Annals. Vol. xiii. Parts ii.-iii. (1900-01). *From the Academy.*

Rochester Academy of Science—Proceedings. Vol. iv. pp. 1-64 (February, 1901). *From the Academy.*

United States Geological Survey, Washington—Map of Alaska showing known Gold-bearing Rocks, &c. (1898): Preliminary Report on the Cape Nome Gold Region, Alaska (1900): Twentieth Annual Report (1898-99). Parts 2, 3, 4, 5 (with Portfolio of Maps) and 7 (1900): Bulletin, 1900. Nos. 163-176 (1900): Monographs. Vol. xxxix.-xl. (1900). *From the Director.*

Washington Academy of Sciences—Proceedings. Vol. iii. pp. 297-362, 363-370 (August, 1901). *From the Academy.*

Wisconsin Academy of Sciences, Arts, and Letters—Transactions. Vol. xiii Part 1 (1900). *From the Academy.*

Bernice Pauahi Bishop Museum, Honolulu—Memoirs. Vol. i. No. 3 (Key to the Birds of the Hawaiian Group. By W. A. Bryan, 1901). *From the Museum.*

Museo Nacional de Montevideo—Anales. Tomo iii. Entrega xx. (1901). *From the Museum.*

Indian Museum, Calcutta—Catalogue of the Indian Decapod Crustacea. Part i. *Brachyura.* Fasciculus i. Introduction, and *Dromiides* or *Dromiacea.* By A. Alcock, M.B., LL.D., F.R.S. (1901). *From the Superintendent.*

Archiv für Naturgeschichte, Berlin. lxvii. Jahrgang (1901). i. Band. 2 Heft; lxvi. Jahrgang (1900). ii. Band. 2 Heft. 1 Hälfte. *From the Editor.*

Gesellschaft für Erdkunde zu Berlin—Verhandlungen. Band xxviii. No. 3 (1901): Zeitschrift. Band xxxv. No. 6 (1900); Band xxxvi. No. 1 (1901). *From the Society.*

Medicinisch-naturwissenschaftliche Gesellschaft zu Jena—Jenaische Zeitschrift. Band xxx. Heft 2-4 (1896); Band xxxi. Heft 2-4 (1897-1898); Band xxxii. Heft 1-2 (1898); Band xxxvi. Heft 1-2 (1901). *From the Society.*

Naturforschende Gesellschaft in Basel—L. Rütimeyer: Gesammelte Kleine Schriften allgemeinen Inhalts aus dem Gebiete der Naturwissenschaft. Nebst einen autobiographischen Skizze, herausgegeben von H. G. Stehlin (2 vols., 8vo, Basel, 1898). *From the Society.*

Naturhistorischer Verein in Bonn am Rhein—Verhandlungen. lvii. Jahrgang. 2 Hälfte (1900): Sitzungsberichte der Niederrheinischen Gesellschaft für Natur- und Heilkunde zu Bonn, 1900. Zweite Hälfte. *From the Society.*

Senckenbergische Naturforschende Gesellschaft in Frankfurt a. M.—Abhandlungen. xxvi. Band. 3 Heft (1901). *From the Society.*

Zoologischer Anzeiger, Leipzig. xxiv. Band. Nos. 650-652 (Aug.-Sept., 1901). *From the Editor.*

K. K. Naturhistorisches Hof-Museum, Wien—Annalen. Band xv. No. 2 (1900). *From the Museum.*

K. K. Zoologisch-botanische Gesellschaft in Wien—Verhandlungen. 50 Band (Jahrgang 1900). *From the Society.*

Société de Physique et d'Historie Naturelle de Genève—Mémoires. Tome xxxiii. Seconde Partie (1899-1901). *From the Society.*

Société Belge de Microscopie, Bruxelles—Annales. 26^{me} Année (1899-1900). *From the Society.*

Société Entomologique de Belgique, Bruxelles—Annales. Tome xlv. (1900). *From the Society.*

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Muséum d'Histoire Naturelle, Paris –Bulletin. Année 1900. Nos. 7-8; 1901, Nos. 1-3. *From the Museum.*

Société des Sciences Naturelles de l'Ouest de la France, Nantes — Bulletin. Tome x. 4e Trimestre (1900). *From the Society.*

Société Linneenne de Normandie, Caen—Bulletin. 5e Serie. Vol. iv. (Année 1900): Mémoires. xxe. Vol. 3e Fasc. (1900-01). *From the Society.*

Société Zoologique de France, Paris—Bulletin. Tome xxv. (Année 1900): Mémoires. Tome xiii. (Année 1900). *From the Society.*

Société Entomolgique de Russie, St. Pétersbourg—Horæ. Tome xxxiii. Nos. 3-4; Tome xxxv. Nos. 1-2 (1901). *From the Society.*

Royal University of Upsal—Three Inaugural Dissertations. "Beitrag zur Kenntniss der Spongienfauna des Malayischen Archipels, &c.," by N. G. Lindgren (8vo., 1898): "Utkast till de Gröna Algernas och Arkegoniaternas Fylogeni," af K. Bohlin (8vo., 1901); "Studier öfver Ostersjöns Hafsalgalflora," af N. Svedelius (8vo., 1901): Bulletin of the Geological Institution. Vol. v. Part i. (No. 9; 1900). *From the University.*

Società Entomologica Italiana, Firenze—Bullettino. Anno xxxii. Trimestre ii.-iv. (1900-01). *From the Society.*

1.—ON *EUCALYPTUS PULVERULENTA*, SIMS.

BY J. H. MAIDEN, BOTANIC GARDENS, SYDNEY.

PREFATORY REMARKS.

My co-worker (Mr. Deane) and myself having brought to an end the series of eight papers on the Eucalypts of New South Wales, which will be found in Vols. xx.-xxvi. (1895 and 1896-1901) of these Proceedings, I have undertaken some further work in connection with the genus, partly of a recapitulatory character. I do not intend to confine my observations to the Eucalypts of this State, for to understand many species it is absolutely necessary to follow them over a range as extensive as possible. I have spared neither pains nor expense to consult types, and I venture to offer to the Society some papers including a number of original observations in regard to certain species, and I will endeavour to clear up difficult points of synonymy.

It seems to me that this method of dealing with a single species will be found most generally useful in practice. Other papers will be submitted from time to time; some further ones have been accepted for publication by other Societies in and out of Australia.

INTRODUCTORY.

I would invite attention to the following passage in Mueller's Eucalyptographia (under *E. pulverulenta*):—

> In the systematic definition and the illustration I have not included an Eucalypt, the leaves of which in aged trees become elongated-lanceolar, much narrowed upward, and even somewhat sickle-shaped, though their base remains rounded and their stalk very short; moreover in the above mentioned state some of the upper leaves become alternate or scattered. This particular Eucalypt was noticed in Upper Gippsland by Mr. A. W. Howitt, and near the Ovens River by Mr. C. Falck. There is every reason to assume that it is merely a state of *E. pulverulenta*, mediating a transit to *E. Stuartiana*.

> Indeed it was with some reluctance that *E. pulverulenta* became at all accepted in the present work, from which all dubious species for distinct illustration have been and are to be rigorously excluded. As, however, *E. pulverulenta* is the only species with opposite leaves, indigenous to the colony of Victoria, it was deemed desirable to accord full elucidation to it. This finally narrow-leaved form of *E. pulverulenta*, when yet in its young bushy state, has the leaves all broad and opposite; but they do not continue in that form, contrarily to what is noted elsewhere. Mr. Falck observed that the bark of this Eucalypt is pervaded by a peculiar somewhat terebinthine odor, so much so as to have given rise to the local name "Turpentine-tree" for this species.

In this passage Mueller refers to a lanceolar-leaved form of *E. pulverulenta* which will be referred to in detail presently. He himself inclined to the belief that it was a form of *E. pulverulenta*, and yet by a train of reasoning that I am unable to follow, he seems to throw doubt on the validity of *E. pulverulenta*, Sims, as a species. There is no doubt, however, that it is a good species, and its recognition dates from the year 1819.

I am of the opinion that the lanceolar-leaved trees in question are a form of *E. pulverulenta*.

Mr. A. W. Howitt brought the matter of the variation of *E. pulverulenta* prominently under notice in a paper on "The Occurrence of *Eucalyptus pulverulenta* in Victoria,"* in which he clearly proves that that species is not different from one of the trees which passes under the name of *E. Stuartiana* in Victoria.

I have studied *E. pulverulenta* in the field from Melbourne in the south to Tenterfield on the New South Wales-Queensland border, and have come to the conclusion that it is more variable than has been hitherto understood, and that the "Apple" or "Peppermint" (not the "But But") of Victoria and the Black Peppermint of New England are conspecific with the Argyle Apple. This will require the description of *E. pulverulenta*, Sims (brief and imperfect like all the early descriptions of Eucalypts) to be amended in the direction indicated by Deane and Maiden under *E. nova-anglica*, namely, that the mature leaves may be lanceolate. *E. nova-anglica* was described on New England specimens, but I find that there are identical forms in Victoria, and perhaps it would be well to recognise Howitt's variety-name *lanceolata* for those forms that depart most from the type. At the same time its use may be inconvenient, since the lanceolar leaves are found also on the type.

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* Seventh Report Aust. Assoc. Adv. Science. Sydney Meeting, 1898.

In my opinion, therefore, the name *E. Stuartiana* should be abandoned for the "Apple or Peppermint" of Victoria and retained for the "Apple or But But" of Victoria, which is the equivalent of the "Apple or White Peppermint" of New South Wales. A separate paper on *E. Stuartiana*, F.v.M., as I understand it, will make my meaning clear.

SYNONYMS.

Eucalyptus pulverulenta, Sims, Bot. Mag., t. 2087.

Eucalyptus cordata, Loddiges, Bot. Cab., t. 328, non Labill.

Eucalyptus perfoliata, Herb. various.

Eucalyptus Stuartiana, F.v.M., B.Fl. iii. 243, and Eucalyptographia, *partim*.

Eucalyptus cinerea, F.v.M., B.Fl. iii. 239.

Eucalyptus pulverulenta, Sims, var. *lanceolata*, Howitt.*

Eucalyptus nova-anglica, Deane and Maiden.†

I doubt that *E. pulvigera*, A. Cunn., is a synonym of *E. pulverulenta*, Sims, (although so stated in B.Fl. iii. 224) for reasons which will be given presently. I will again refer to the matter when I deal separately with *E. cordata*, Labill.

E. cordata, Lodd., Bot. Cab., t. 328.—There is a general account but no proper description of this plant, which would be ignored except for the figure.

The plant is referred to in Link's Enumeratio, p. 31, in the following words—" E. cordata, Loddig., Bot. Cab. Hab. in Australia. Eucalypti species rarissime in hybernaculis florent, et in foliis simillimæ sunt, hinc difficile diagnoscuntur dubias itaque tantum licuit proponere species," an unsatisfactory description which is given here because of the rarity of the work.

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* Report Aust. Assoc. Adv. of Sc. vii. 517 (Sydney Meeting).

† These Proceedings, xxiv. 616.

Loddiges' figure is almost a facsimile of that of *E. pulverulenta*, Sims, (Bot. Mag. t. 2087).

In Herb. Oxon. there is a specimen "Eucalyptus cordata, Loddiges culta." It is probably *E. pulverulenta*, Sims, an opinion already expressed by Mueller in Eucalyptographia; at the same time I do not think it would be possible from the material available, and in absence of notes on the bark, to say that it is not the *pulvigera* form of *E. cordata*.

Loddiges states that his plant was a native of Van Diemen's Land; if this be correct (and a mistake can easily be made) it cannot be *E. pulverulenta*, as that species has not yet been discovered in Tasmania. Loddiges' plate was published in 1819, and it is quite possible that the plant was raised from *cordata* (*pulvigera*) seed collected by Allan Cunningham or Fraser in the Expedition of 1817. It is also possible that the plant was raised from seed of true *pulverulenta* gathered in the County of Argyle or Camden, N.S.W. The point can hardly be settled without further evidence.

a. E. perfoliata, Cult. Madeira (Mount Villa, July, 1837). Coll. Dr. J. F. Lippold, ex herb. Prof. R. Graham in herb. Cant. In young bud only. This seems to be *E. pulverulenta*, Sims.

A specimen in leaf only in herb. Cant. (Mus. Martyn) bearing the label "this more round-leaved than the other" has small, nearly orbicular perfoliate leaves. It may be *E. pulverulenta*, Sims.

b. E. perfoliata, Desf., may be *E. globulus* (B.Fl. iii. 200).

c. E. perfoliata, A. Cunn. MS., may be *E. Stuartiana*, F.v.M., or *E. Cambagei*, Deane and Maiden (see p. 557).

d. E. perfoliatus, Hort. Bot. Cantab. 6th April, 1834. J. S. Henslow. In herb. Cant. In bud only.

This is probably *E. pulverulenta*, Sims. At the same time it may be the *pulvigera* form of *E. cordata*.

E. cinerea, F.v.M. (B.Fl. iii. 239). Leaves opposite, sessile, cordate, ovate or ovate-lanceolate, obtuse or acute . . . with three to seven pedicellate flowers. Near Bathurst (A. Cunningham), Lake George, Goulburn district.

Mueller (Fragm. ii. 71) says that *E. pulverulenta*, Sims, was formerly distributed under the name of *E. cinerea*. Bentham (B. Fl. iii. 239) commenting on this says, "as far as our specimens go, it appears to differ (from *E. pulverulenta*) in the foliage, in the larger sessile flowers, and in the larger, thicker fruit with a very prominent thick rim." I may mention that when I took charge of the Sydney Botanic Gardens all the *E. pulverulenta* trees were labelled *E. cinerea*. Most of them are about 30 years old, and whatever their appearance when they were first planted, they are now typical *E. pulverulenta*, Sims.

I have recently had the opportunity of examining the specimens, seen by Bentham, in the Kew Herbarium. They are labelled "*E. cinerea*," and called "Bathurst Stringybark." They are undoubtedly *E. pulverulenta* with the leaves more lanceolar than in the strict type, but only intermediate in character in this respect between the type and the commonest Victorian and New England forms.

It will be observed that Woolls (Plants of New South Wales, p, 55) follows Mueller in placing *E. cinerea* under *E. pulverulenta*.

Some further notes on synonymy will be given at p. 554.

AFFINITIES.

The closest affinity of *E. pulverulenta*, Sims, is undoubtedly with *E. cordata*, Labill. The affinities with *E. Risdoni* and *E. globulus* are of a more superficial character.

A.—*E. pulverulenta* and *E. cordata*.

E. pulverulenta has the branchlets generally more slender and not acute-angular, the leaves not crenulated, but dotted with roundish almost uniform oil-pores, the flowers generally smaller, the tube of the flowering calyx downward obconically attenuated, while the lid is less depressed, the fruit is smaller, more top-shaped, and has a comparatively broader rim; the convergent free part of the valves emanates almost at a level with the calyx edge and arises not distinctly beneath the rim. The furrow between the discal lining and the calyx-tube is running just beneath the edge of the fruit, not forming a faint vertical channel around the rim (Eucalyptographia, under *E. cordata*).

Nevertheless it is not always easy to separate *E. pulverulenta* from *E. cordata* on herbarium specimens alone. I have not seen *E. cordata* with flowers in more than threes; in *E. pulverulenta* this is not uncommon, particularly in the lanceolar form.

The leaves of *E. cordata* from Tasmania are usually large, but particularly from New South Wales localities they are frequently as small as those of typical *pulverulenta.*

The leaves of *E. pulverulenta* are usually thinner than those of *E. cordata*, but this is a character which must be employed with caution.

The crenulation of the leaves of *E. cordata* from New South Wales localities is often absent or nearly so.

The bark of *E. pulverulenta* is always fibrous, partaking more or less of a Stringybark character; that of *E. cordata* is smooth or ribbony. The *E. pulvigera* of Cunningham is identical with *E. cordata* in regard to bark.

There is a specimen (cultivated) ex hort. Kew, labelled *E. pulverulenta*, in Herb. Calcutta. It is in flower only. It is probably correctly named, yet most of the cordate leaves are slightly crenulated, a character regarded as belonging to *E. cordata* rather than to *E. pulverulenta.* The twigs are quadrangular and glandular, and much of the young foliage is lanceolate.

No. 16862, J. S. Gamble, Sept. 1885, Wellington (6000ft.) Nilghiris, Madras, is labelled *E. pulverulenta*, Sims, and may be that species. But in the absence of ripe fruits or notes on the bark it may be a western New South Wales form (*pulvigera*) of *E. cordata.*

B.—*E. pulverulenta* and *E. Risdoni.* A specimen ex herb. Paris, in herb. Barbey-Boissier, collected 1844, probably by Verreaux, is *E. Risdoni*, Hook., although labelled *E. pulverulenta.* There is no doubt that the shape of the leaves in the two species is often very similar.

C.—*E. pulverulenta* and *E. globulus. E. pulverulenta*, Link, (Enumeratio, p. 31), is, according to Mueller (Eucalyptographia) *E. globulus*, Labill., the confusion having undoubtedly arisen through the glaucousness and the shape of the sucker leaves of the latter. A specimen of *E. globulus*, probably collected by Verreaux, and labelled "E. pulverulenta, Tasmanie, No. 85, ex herbario Musæi Parisiensis, 1844," in herb. Barbey-Boissier, is additional evidence of the confusion between these two species that formerly existed.

RANGE.

Eucalyptus pulverulenta, Sims, in its typical form occurs in New South Wales in the southern mountainous country from about Tumut to Berrima, and thence westerly to the Bathurst district. Its precise range is not yet defined.

North from these places, *e.g.*, in New England and Southern Queensland (we have yet to learn the intermediate localities between Berrima or Bathurst and New England), and south into Victoria the species is diffused; but as we proceed further from the type localities the leaves become more or less lanceolar. It does not appear that *E. pulverulenta* has yet been found in Tasmania, though it should be searched for.

New South Wales (typical form).—In July, 1891, the late Rev. Dr. Woolls showed manna from *E. pulverulenta* to this Society from Buckley's Crossing, Snowy River. Not only was this the first record of manna on the species, but the most southerly definite record of the species. A few years ago, on the information of Mr. Augustus Hooke of Tia, I gathered a large quantity from the lanceolate-leaved form of New England.

Tumut (E. Betche and W. W. Froggatt), Lake George, Argyle County (Backhouse), Goulburn, Wingello, Barber's Creek, &c., where it is known as Peppermint. Berrima "Argyle Apple" (Woolls). It is sometimes known as "Silver-leaved Stringybark." Here is an abundance of small stunted shrubs (as well as small trees) of this species which would be readily taken for *E. Stuartiana* in that (shrubby) stage. In fact the resemblance of the young growth of the species is remarkable.

Limekilns near Wattle Flat, 20 miles northerly from Bathurst (R. H. Cambage). See also localities under *E. cinerea*.

[N.B —The westerly trees pass into the lanceolar form just as do those in the extreme south of New South Wales.]

Victoria (mostly lanceolate-leaved forms).—Beechworth, Ovens River (C. Falck). Labelled by Mueller at various times *cinerea* and *dealbata*. Some of the specimens are nearly typical *pulverulenta*, others incline more to the lanceolate form. In 3's.

Another specimen from Mr. Falck labelled "Peppermint tree."

Peppermint tree of the Ovens River. "Cortex diutius persistens" (Mueller, Feb., 1853).

McAllister River. "Placed doubtfully under *viminalis* by Bentham" (Mueller).

Anderson's Creek (C. Walter); Dandenong Mountain (J.H.M.); Nunawading (Boyle); Ringwood (R. H. Cambage); Lilydale to Healesville (J. G. Luehmann); Upper Yarra (C. Walter).

I am indebted for most of the above Victorian specimens to Mr. J. G. Luehmann, National Herbarium, Melbourne.

The following specimens were all placed at my disposal by Mr. A. W. Howitt. They are nearly all collected in the Gippsland district of Victoria, and are of especial interest as illustrating his paper above referred to. I place them all under *E. pulverulenta*:—Oakleigh; Boolara; Monkey Creek, South Gippsland; Dargo Road, North Gippsland; Moe (leaves mostly cordate and up to 8 flowers in axils); Buchan (typical except multiflowered near Black Flat); Croydon; Bunyip.

New South Wales (lanceolate-leaved form).—Vide *E. nova-anglica*, Deane and Maiden (these Proceedings, xxiv. 616), noting the localities there given.

New England (C. Stuart). "Doubtfully referred by Bentham to *E. viminalis*."

"Peppermint," New England (W. Woolls).

Gwydir (Leichhardt), labelled *E. viminalis*, var. *pluriflora*, Benth.

Tenterfield district, where it is locally known as "Red Peppermint." It has suckers which are with difficulty distinguishable from those of *E. Stuartiana.*

"Peppermint Box," The Bluff, Tenterfield (H. Deane).

Glen Innes (H. Deane).

Ben Lomond (J.H.M.).

"Black Peppermint," Yarrowitch to Walcha, very abundant, and New England generally (J.H.M.).

No 2 variety of *E. Stuartiana,* viz.: "Broad-suckered Peppermint" of my paper, A.A.A.S. (Sydney), 1898, p. 541.

Besides "Black Peppermint" this species also goes under the name of "Red Peppermint" in New England. Mr. J. F. Campbell, of Walcha, tells me that it grows on slate and basaltic flats of fair quality of soil. I have seen large quantities of manna produced by this species. This is the "Peppermint" timber which is used in New England, that of the "White Peppermint" (*E. Stuartiana*) being practically valueless.

"The timber of this species is very good as posts, but apt to split in seasoning. A dead tree apparently quite sound when cut through the sap timber has cracks running into the heart-wood. At the Int. Exh., 1879, I exhibited a piece of a post made of a young tree of this species 10 inches in diameter. The log was split in halves and used for posts. It had been erected about 1844, and was quite sound when dug up" (A. R. Crawford, Moona Plains, *in litt.*)

It is common on swampy, heathy flats, between Eden and Cape Howe, in the extreme south-east of New South Wales (J. S. Allan). Attains a height of 30ft., and a diameter of 1ft. These trees are identical with the Victorian ones. Flowers numerous.

Queensland (lanceolate-leaved form).—Killarney (F. M. Bailey); Stanthorpe (F. M. Bailey), labelled "*E. dealbata,*" an old naming of Mueller, through confusion with a glaucous form of *E. tereticornis.* (See these Proceedings, xxv. 446).

2.—ON *EUCALYPTUS STUARTIANA*, F.v.M.

By J. H. Maiden, Botanic Gardens, Sydney.

This is but one of many species of Eucalyptus in regard to which there has been much confusion in the synonymy. I have shown under *E. pulverulenta* the confusion of *E. Stuartiana* with that species, and under *E. Gunnii* I will make further allusion to the confusion of *E. Stuartiana* with that species also. It would perhaps be an advantage if the name of *E. Stuartiana*, F.v.M., could be removed from the list of Eucalypts, but such a step would be impossible; and the wisest course seems to me to restrict it to the widely diffused "Apple" of New South Wales and Northern Victoria. I emphasise the remarks made by Mr. Deane and myself on *E. Stuartiana* (these Proceedings, xxiv. 628). It seems to be an unnecessary addition to an already overburdened literature to again describe the species; the descriptions in B.Fl. iii. 243 (modified as to the bark, which is of a "Box" character, thickish, whitish, and often zigzagged or wrinkled on the outside); in the Eucalyptographia, and of Mr. Baker (under *E. Bridgesiana*), are adequate.

Amongst those forms labelled "*E. Stuartiana*, F.v.M." by Mueller this is probably the most widely diffused, it was so named by Mueller more frequently than any other form, and adoption of the name would involve a mininum of disturbance of botanical nomenclature. I have again referred to the matter under *E. Gunnii*, Hook. f., var. *acervula*, Deane and Maiden.

Its commonest name in New South Wales and North-eastern Victoria is "Apple," but it must not be confused with *Angophora*. It is the "But But" of Gippsland, as pointed out by Mr. Howitt, a designation that separates it from *E. pulverulenta*. It is perhaps the "Woolly Gum" of Berrima (Macarthur in N.S.W. Exhib. Cat. Paris 1855, London 1862).

It is sometimes called "Woolly Butt," but must not be confused with *E. longifolia.*

It is the "Apple-tree Gum" of Mr. De Coque (Journ. R. Soc. N.S. Wales, xxviii. 212).

Owing to the "Box" (*E. hemiphloia*) appearance of the bark, it has for many years been looked upon as a Box in some districts, though an inferior one. Macarthur (No. 15, N.S.W. Exhib. Cat. London, 1862) calls it "Box," but adds, "Said to be good, but certainly not equal to the other varieties of box." In New England I have often heard it called "White Box" to this day. Sometimes it is called "Bastard Box."

Called "White Peppermint" in New England, in contradistinction to "Black Peppermint" (*E. pulverulenta*).

I have insisted for many years on the value of a timber as a botanical character. That of *E. Stuartiana* is pale-coloured and dull looking, often a good deal resembling that of Box (*E. hemiphloia*) when fresh, but of little tensile strength, and one of the least durable timbers in New South Wales. It is also one of our worst firewoods.

SYNONYMS.

E. Stuartiana, F.v.M., B.Fl. iii. 244 (*partim*).

E. Stuartiana, F.v.M.. Eucalyptographia (*partim*), excluding in both cases the references to the "Red Gum" of Tasmania and to the "Peppermint" of Victoria.

E. perfoliata, A. Cunn. MS. (probably).

E. Bridgesiana, R. T. Baker, P.L.S.N.S.W. xxiii., 164 (1898).

E. Stuartiana, F.v.M., var. *parviflora*, Deane and Maiden, *ib.* xxiv., 628, 1899.

E. angophoroides, R. T. Baker, *ib.* xxv., 676, 1900.

E. perfoliata, A. Cunn. MS.

E. perfoliata was a name very loosely used three-quarters of a century ago. It was applied to *E. pulverulenta*, Sims, and other species.

Allan Cunningham's Journal (p. 169) under date 11th April, 1817, contains the following entry:—"*Eucalyptus perfoliata* of

Kew Gardens is very frequent, and another species (probably *E. dives*, Schauer, J.H.M.), with cordate, sessile leaves, and others lanceolate and inserted on a petiole" (Mt. York and near Vale of Clwydd). Again, under date 15th August, 1817, nearing Bathurst from the west, he says, "The *E. perfoliata* of the Vale of Clwydd is very common."

The above Eucalypt may be either *E. Stuartiana* or *E. Cambagei*.

AFFINITIES.

The closest affinity is with *E. pulverulenta*, Sims (q.v.).

The more closely these two species are studied, the more evident it becomes that they have many points in common. Mr. R. T. Baker (these Proceedings, xxv., 667) is of opinion that *E. Stuartiana* (*Bridgesiana*), whose bark yields an oil, differs in this respect from *E. pulverulenta* (formerly *Stuartiana*, partim). This is, however, an erroneous assumption, Mr. C. Falck calling the latter tree "Turpentine tree" by reason of the oil in the bark (Eucalyptographia, under *E. pulverulenta*).

The affinity with the smooth-barked *E. Gunnii* is less close, and the confusion arose in regard to herbarium material only.

RANGE.

Tasmania.—King's Island, Bass Straits (in bud only, and therefore a little doubtful; in Herb. Melb.).

Victoria.—The following six Gippsland localities are by Mr. A. W. Howitt, who has kindly favoured me with specimens. They are all his "Apple tree or But But":—

Castle Burn Creek, Crooked River Road; Stratford; Toongabbie; Lily's Leaf; Four Mile Creek, Port Road; and Dargo.

The following are some additional Victorian localities:—

Moyston (D. Sullivan); Ovens River, Timber No. 125, 1861; Bright District (J.H.M.); Hume River (Jephcott).

The following two statements embody Mr. Howitt's views of the "But But" of Victoria. I have consulted Mr. Howitt in the matter.

"This species is well marked, and is one of the most persistent in character of any of the Eucalypts of Gippsland. Wherever I have seen it I have found it to be a tree with somewhat large and spreading limbs, with a scaly, wrinkled bark, which is persistent up to the small branches.

"The wood of this tree is valueless for splitting, sawing and even for fuel. Its general appearance has caused it to be confused with *E. hemiphloia*, under the name of 'White Box.'"—(Trans. Roy. Soc. Vict., ii.).

The next passage is from an official report:—

E. Stuartiana, the "Apple tree" or "But But," grows to great size in parts of Gippsland, and is also found in the north-eastern district. It is without exception the most worthless of Victorian Eucalypts, yet some years back I saw it cut for bridge building, and within the last five years I saw it cut for sawmill purposes in Gippsland under the name of "White Box."

New South Wales.—This tree is found over the greater part of this State. Following are the localities of some of the specimens in the National Herbarium, Sydney :—

"Cabbage Box," Nangutta (W. Bäuerlen); Colombo, Lyttleton "Apple-topped Box," with very hemispherical fruit, brown rim well developed (W. Bäuerlen); Lower Araluen (J.H.M.); Mogo, Moruya (W. Bäuerlen); Queanbeyan (H. Deane); Bungendore (W. Bäuerlen); Goulburn (J.H.M.); Yass (W. W. Froggatt); Tumut (F. R. Mecham); Albury (J.H.M); Germanton (the valves very exserted; W. Forsyth); Young (J.H.M.); Gundagai (F. R. Mecham).

Grenfell, "Apple," bark of this tree grey in colour, thick, wrinkled on the trunk but smoother on the limbs, like White Box, but much rougher; the timber is soft, not durable, and makes bad firewood; there are few in this neighbourhood (Forester Postlethwaite): Parkes (J.H.M.); Molong (H. Deane); Murga, between Cudal and Eugowra (H. Deane); Stuart Town (A. Murphy); "Woolly Butt," North of Castlereagh (W. Forsyth); "Apple," Perth, Orange (W. S. Campbell); Bathurst (J.H.M.);

"Peppermint," Mudgee (Woolls); Rylstone (R. T. Baker); Mt. Vincent, Ilford (R. T. Baker); "Peppermint," Capertee (J.H.M.); "Peppermint," Warrah Creek (Jesse Gregson); over New England generally, where it is considered a worthless timber.

The "White Peppermint" grows on many of the slaty ridges around Walcha (Silurian). It is not abundant, and is of no commercial value, although sometimes used for fencing in the absence of better material. The timber, which is of a pale red in colour, is soft and liable to decay, also to the ravages of the white ant. The tree grows to an average height of 40 feet with an average girth of about 8 feet. It is often gnarled and stunted and generally has the appearance of being elbowed out of existence by *E. eugenioides* with which it shares the ridges. The bark is semi-persistent and faintly regular throughout, shedding its waste material in a kind of whitish flaky dust (J. H. Campbell, Walcha).

Timbarra, "A Stringybark, *E. goniocalyx* or *E. viminalis*," on label (C. Stuart); "White Box," Cottesbrooke, near Tenterfield (J.H.M.).

"Black Peppermint" Glen Innes (H. Deane) yet *Stuartiana*, I think; "Apple tree" Tenterfield, with sessile fruits (H. Deane). Precisely the same form was collected by Charles Stuart at Tenterfield, and his label is "No. 2, termed here 'Peppermint Gum.' A large tree 40-50 ft. with a wide spreading head. The bark rugose on the trunk but smooth on the upper branches." Has large very thick leaves.

C. Stuart collected the same species in New England. His label reads, "Bark rather rough and fibrous." Mueller's label of many years ago is "*Euc. viminalis* var. *capitata*."

I collected a narrow-suckered form seven miles east of Walcha. Suckers narrow for *Stuartiana*, but in no other respect differing from that species.

Queensland.—*E. Stuartiana* also occurs at Stanthorpe according to specimens received from Mr. F. M. Bailey.

3. ON *EUCALYPTUS GUNNII*, HOOK. F.

By J. H. MAIDEN, BOTANIC GARDENS, SYDNEY.

Eucalyptus Gunnii, Hook. f., London Journ. Bot. iii., 499 (1844).

I think that this will be found to have the most profuse synonymy of any species of Eucalyptus. I give it as fully as I can; it is not likely that it is perfectly complete. I propose to recognise four varieties in addition to the type. They are :—

A.—var. *acervula*, Deane and Maiden (these Proceedings, xxvi., 136).

B.—var. *ovata*, Deane and Maiden (*op. cit.*, xxvi., 136).

C.—var. *rubida*, var.nov.

D.—var. *maculosa*, var.nov.

Following is a list of the synonyms arranged, as far as I can do so, under the above varieties.

SYNONYMS.

Type.—*E. Gunnii*, Hook. f. var. *glauca*, Deane and Maiden (these Proceedings, xxiv., 464, 1899).

E. Perriniana, Herb. Perrin, non F.v.M.

A.—var. *acervula*, Deane and Maiden.

*1. *E. Patersoni*, R.Br. Herb.
2. *E. persicifolia*, Lodd. (Bot. Cab. t. 501).
3. *E. persicifolia*, Miq. (Ned. Kruidk. Arch. iv. 137).
4. *E. Baueriana*, Miq., non Schauer (*ib.* iv. 137).
5. *E. citrifolia*, F.v.M. Herb. (*ib.* iv. 137).
6. *E. ligustrina*, Miq., non DC. (*ib.* iv. 134).

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* These numbers correspond to the supplementary information given in regard to these species.

7. *E. acervula*, Miq. (*ib.* iv. 137).
8. *E. acervula*, Hook. f., non Sieb. (Fl. Tas. i. 135).
9. *E. Stuartiana*, F.v.M. (Miq. Ned. Kruidk. Arch. iv. 131).
10. *E. Gunnii*, F.v.M. (Fragm. ii. 62).
11. *E. undulata*, Oldfield.

E. viminalis, Benth. (B.Fl. iii. 240) non Labill. (*partim*).

E. paludosa, R. T. Baker (these Proceedings, xxiii. 167; *ib.* xxvi. 136).

B.—var. *ovata*, Deane and Maiden.

1. *E. ovata*, Labill. (Nov. Holl. Pl. Sp. ii. 13, t. 153).
2. *E. androsemæfolia*, Hoffmg. (Verz. Pfl. Nachtr. ii. 113).
3. *E. mucronata*, Link (Enum. Hort. Berol. ii. 30).
4. *E. camphora*, R. T. Baker (these Proceedings, xxiv. 298).

C.—var. *rubida*, var.nov.

1. *E. granularis*, Sieb. Herb.

E. fabrorum, Herb. Behr, non Schlect. (*partim*).

2. *E. Gunnii*, Miq. (Ned. Kruidk. Arch. iv. 126).
3. *E. viminalis*, Labill. var. B., Howitt.

E. viminalis, Labill. var. (B.Fl. iii. 240) *partim.*

E. rubida, Deane and Maiden (these Proceedings, xxv. 456).

D.—var. *maculosa*, var.nov.

E. maculosa, R. T. Baker (these Proceedings, xxiv. 598).

E. lactea, R. T. Baker (*op. cit.* xxv. 691).

Type.—In most of the typical *Gunnii* specimens the operculum has only about half the length of the calyx, but this is not an absolute character.

Mr. L. Rodway sends me from Tasmania a form with glaucous fruits more hemispherical than cylindrical. It is, however, very near the type.

The notes on the timber, distribution, &c., of *E. Gunnii* by various authors frequently cannot be classified under varieties.

Following are some type specimens examined by me. They are all from Tasmania of course. See Hooker's Fl. Tas.

(*a*) Gunn's 1080/1842. "Marlborough, received as such by R. C. Gunn." To this label has been added later, "Cider Tree, March 1840." A specimen in herb. Cant. ex herb. Lindl., is in late flower, with neither buds nor fruits. The stalks and foliage have a strong yellow cast. The calyces are glaucous.

(*b*) Gunn's 1084. "Lake Arthur. A tree yielding rich cider. 18/2/43."

The fruits riper and therefore more cylindrical than shown in Hooker's plate. As regards the buds, some of them have pointed opercula as shown at fig. 1 of the plate; the others have blunt opercula as shown on the main figure. The buds and fruits are alike glaucous.

(*c*) Gunn's 1963. The sheet contains two specimens:—(1) "Foot of Lake Echo tree." (2) "Uncertain where collected." Both are labelled in the handwriting of Hook. f. In herb. Syd. ex herb. Hook. The fruit is more hemispherical in No. 1963 than in some of the other specimens.

Following is an account of *E. Perriniana.* In these Proceedings (xxvi. 135) it is stated that this form is identical with *E. Gunnii,* Hook. f., var. *glauca,* Deane and Maiden, which is undoubtedly the case, but as will be explained presently, I am of opinion that the variety *glauca* should not be maintained, and it and *E. Perriniana* should be simply placed under *E. Gunnii,* Hook. f., they being not sufficiently removed from the type.

E. Perriniana, Herb. Perrin (non F.v.M. as quoted) see (1) Report A.A.A.S. Melbourne, 1890, p. 557; (2) Proc. R.S. Tasmania, 1893, p. 181. This Tasmanian plant has not been fully described in a technical sense. In the first Mr. Perrin exhibited the plant, discussed its relation to *E. cordata,* partly described it and added, "I am of opinion that . . . (this) . . . will be found to be a new species."

In the second Mr. Rodway alludes to it as *E. Perriniana,* F.v.M., further describes the plant and its habitat, and concludes that it bears the same relation to *E. viminalis* that *E. Risdoni* does to *E. amygdalina*. Mr. Rodway has kindly favoured me with specimens.

The leaves are stem-clasping and sometimes perfoliate. We have leaves of this character in the Snowy Mountains (New South Wales) and from other places, showing that this is a form not peculiar to Tasmania.

Victoria.—Summit of Mount Baw Baw (Mueller). Mentioned in B.Fl. (iii. 247) as typical. I have seen the specimens examined by Bentham. The fruits have a slightly domed rim, connecting with the very domed Mt. St. Bernard form. The Mt. Baw Baw specimens are intermediate in character between the type and those from Mt. St. Bernard, but all are undoubtedly near the type.

Mt. St. Bernard (J.H.M.). A glaucous tree; fruits in threes, and slightly urceolate as in the typical *Gunnii;* the domed valves somewhat exserted, the fruits nearly truncate when not quite ripe: long undulate leaves; sucker leaves nearly orbicular. The same from Wentworth River (A. W. Howitt).

The large leaves show transit to var. *acervula;* the domed valves of the fruit are unmistakably like var. *rubida*. The fruits show affinity with *E. Maideni* and *E. goniocalyx*.

New South Wales.—All these are very near the type, in fact closer to the type than any I have seen from Victoria so far. In some cases with very ripe fruits there is a slight doming of the rim and exsertion of the valves such as we see more intensified in the Mt. St. Bernard specimens. Most of the type-specimens that I have seen have the fruits not fully ripe, and I believe that if they were fully ripe some of them would show a slight exsertion of the valves and even a slight doming of the rim.

All these New South Wales specimens, except otherwise indicated, are var. *glauca*, Deane and Maiden (these Proceedings, xxiv. 464, 1899), which I think can no longer be maintained as a variety, as already hinted.

Tingiringi Mt. (5,400 ft.) near Delegate. "Forms a Mallee scrub, but sometimes single trees of 40 ft." (W. Bäuerlen). Usually small leaves; glaucous, very small young leaves. Sometimes glaucous mature foliage. Glaucous twigs, inflorescence and fruits. Capsule sunk when not fully ripe. Points of valves hardly protruding. Fruits in threes.

Snowy Mts. (5,000 ft). Young leaves very large, perfoliate. On mountain slopes and descending into gullies amidst scrub of *Leptospermum*. Wollondibby, Jindabyne (both W. Bäuerlen). Cooma district (J.H.M.).

Nimbo Station, head of Queanbeyan River. "Flooded or Cabbage Gum"; smooth-barked tree, with reddish-brown flakes (H. Deane).

There is no question that these forms show transit to var. *rubida.*

Top of Canoblas, Orange (R. H. Cambage). This is an intensely glaucous form, the operculum larger in proportion to the calyx, the valves well exserted. It has the sharp *Gunnii* rims to the buds.

This connects typical *Gunnii* and var. *rubida* excellently. It has the fruit and other characters of *rubida;* on the other hand it is unmistakably *Gunnii* and an additional instance of how protean the species is.

A.—var. *acervula*, Deane and Maiden.

Typical *E. Gunnii*, Hook. f., is from the cold mountainous districts of Tasmania and is usually more or less glaucous. Flowers in threes.

Var. *acervula* is the common or low country form of the species, and, like the type, often grows in damp places. Flowers 4-8 usually.

Following are details in regard to some of the synonyms.

1. *E. Patersoni*, R.Br. herb. In Herb. Brit. Mus. and Kew are specimens of var. *acervula* labelled in Robert Brown's handwriting "Port Dalrymple (Tas.) gathered by Col. Paterson."

2. *E. persicifolia*, Lodd. (Bot. Cab. t. 501).

"This plant is a native of New Holland, and was introduced several years since; it is a large evergreen branching shrub or small tree. The flowers are produced in axillary heads from six to twelve blossoms each, usually situated at some distance below the ends of the shoot: they are very long before they expand, which is generally the case in this genus, and have no scent. Our drawing was made in July last, from flowers which had been full twelve months coming to perfection." It will be seen that, although often quoted, this plant has not been botanically described.

Var. B. is Sieber's No. 593, see Don, ii. 818.

I have not seen Loddiges' plant, which Bentham refers to *E. viminalis* (of which, if correctly referred to that species, it must be a multiflowered form). There is nothing, however, in Loddiges' figure inconsistent with the view that the plant is a multiflowered form of *Gunnii* (*e.g.* var. *acervula*), and partly in view of Mueller's determination of Miquel's *E. persicifolia*, I refer Loddiges' plant also to *E. Gunnii* (var. *acervula*).

The Index Kewensis states that *E. persicifolia*, Lodd., is synonymous with *E. Stuartiana*. By that *E. Gunnii*, Hook. f. var. *acervula* is probably meant.

3. *E. persicifolia*, Miq., non Lodd., referred to briefly in Ned. Kruidk. Arch. iv. 137 (1856) as follows:—

"29. *Eucalyptus persicifolia*, Lodd.—DC. Prod. iii. p. 217, n. 8 (?) Van Diemensland (Stuart n. 12)."

I have not seen the plant referred to by Miquel, but Mueller (Eucalyptographia) states that it is a form of *E. Gunnii*. In Index Kewensis referred to *E. Stuartiana* just like *E. persicifolia*, Lodd. (*supra*).

Schlechtendal in Linnæa, Vol. 20, p. 659, has the following. I have not seen his specimen:—

"181. *Eucalyptus persicifolia*, Lodd., DC. Pr. iii. p. 217, n. 8. Specimina nondum florentia differunt a Sieberianis: foliis brevioribus, umbellis longius pedunculatis floribusque longius pedicellatis.

Altera forma similis ramulis tenuioribus, foliis angustioribus nec brevioribus, pellucide punctatis et minus crasse coriaceis, floribus minoribus, calyptris obtusioribus longius distare videtur, sed ex paucis speciminibus in tanta formarum affinitate certum quid contendere non audeo."

4. *E. Baueriana*, Miq. non Schauer, referred to in Ned. Kruidk. Arch. iv. (1856), 137, as follows:—

"30. *Eucalyptus Baueriana*, Schauer (?), Walp. Rep. ii. p. 925. *E. citrifolia*, F. Müll. Herb. Tasmania borealis (Stuart).

I have seen a specimen (*cf. E. citrifolia*, F.v.M. Herb.) in Herb. Barbey-Boissier which is *E. Gunnii*, var. *acervula*. In the Index Kewensis *E. Baueriana*, Miq., is referred to *E. Stuartiana*, which is the "Red Gum" of Tasmania, and identical with *E. Gunnii*, var. *acervula*. I have a memorandum of having seen when at Kew a specimen labelled "*E. Baueriana*, Miq." and of having referred it to "the lowland form of *E. Gunnii*," which is another name for *E. Gunnii*, var. *acervula*.

5. *E. citrifolia*, F.v.M. Herb. See *E. Baueriana*, *supra*. I have seen "Plantæ Müllerianæ, *Eucalyptus citrifolia*, F. Müller, Nov. Holland méridional" (one of Miquel's labels). In Herb. Barbey-Boissier.

It is in flower and early fruit only, with rather broad shiny Citrus-like leaves, hence the specific name. It is *E. Gunnii*, var. *acervula*, and is identical with *E. Baueriana*, Miq., non Schauer.

6. *E. ligustrina*, Miq., non DC., referred to in Ned. Kruidk. Arch. iv. (1856), 134, as follows:—

"24. *Eucalyptus ligustrina*, DC., Prod. iii. p. 219, n. 24 (?). Van Diemensland (Stuart)."

I have not seen the specimen, which Mueller (Eucalyptographia) says belongs to *E. Gunnii*. It is not at Kew.

7. *E. acervula*, Miq., non Sieb., Ned. Kruid. Arch. iv. (1856), 137.

I have examined *Euc. acervula*, Miq. leg. R. Brown, from Herb. Brit. Mus., Kew, Berol.: and other herbaria.

The same, R. Brown, 1802-5, from the Derwent, Tasmania, distributed from Herb. Brit. Mus., 1876. This specimen, in some collections, bears the label "*E. viminalis* (?)." I have not seen any number attached to it.

It is in every way identical with *E. Gunnii*, Hook. f. var. *acervula*.

Bentham (B.Fl. iii. 207) gives *E. acervula*, Miq., as a synonym of *E. macrorrhyncha*, F.v.M. This mistake has probably arisen through some confusion with *E. acervula*, Sieb., although Bentham mentions "non Sieb." *E. acervula*, Sieb., is a Stringybark (*E. eugenioides*, Sieb.) like *E. macrorrhyncha*, F.v.M.

Mr. Rodway, one of our best botanists, also confuses *E. acervula*, Miq., with *E. acervula*, Sieb., in the following passage, through not having seen the types, or perhaps by following Hooker (Fl. Tas.), whose *E. acervula*, Sieb., is wrong. "*Eucalyptus acervula*, Sieb. This is a very common Tasmanian Gum, and though in some respects nearly related to *E. Gunnii*, is consistently distinct. Its habit and bark, its thinner undulate leaves and numerous flowers, its peculiar turbinate fruit, with protruding valves, make it very distinct, yet Mueller not only combines it in his Eucalyptographia with *E. Gunnii*, but rejects the type established by Hooker of that species and replaces it with a plate of the typical *E. acervula*, Sieb." (Proc. R.S. Tas., 1898-99, p. 104). The reference to the Eucalyptographia plate is not quite accurate. The main twig and the cluster of buds at the left hand top corner are both var. *acervula*. The rest of the illustrations are typical *Gunnii* or nearly so. On the mainland, at all events, *E. Gunnii* runs into var. *acervula*, and the evidence I will presently adduce shows, in my opinion, that the same is the case in Tasmania also.

8. *E. acervula*, Hook. f., non Sieb. (Fl. Tas. i. 135, as *E. acervula*, Sieb.).

I have examined the following specimens of Hooker's types of the above:—

1088, R. Gunn. Herb. Cant. ex herb. Lindl. In bud and flower.

1089, R. Gunn. Ralph's Bay, V.D.L., 1842. In Herb. Cant. ex herb. Lemann and herb. Lindl.; in plump bud and early fruit.

1093, R. Gunn. New Norfolk, V.D.L., Herb. Cant. ex herb. Lemann; in plump bud. Herb. Cant. ex herb. Lindl., and herb. Syd. ex herb. Kew; in flower and early fruit. This specimen is sometimes labelled "*E. Stuartiana*, F.M."

1096, R. Gunn. New Norfolk, V.D.L., 1842, labelled "*E. acervula*, Sieb." Herb. Cant. ex herb. Lemann; in bud and young fruit only. A second specimen in bud and flower in herb. Cant. ex herb. Lindl.

1097, R. Gunn. Launceston, V.D.L., 1842. Herb. Cant. ex herb. Lemann; in bud and early fruit. Herb. Cant. ex herb. Lindl.; in flower and early fruit. This labelling, "*E. acervula*, Sieb., R. C. Gunn, ex herb. Hook." is attached to many specimens of *E. Gunnii*, Hook. f., var. *acervula*, Deane and Maiden, in European herbaria.

There is a specimen labelled in Oldfield's hand writing, "Red Gum, Tasmania, *E. acervula*," in herb. Calcutta.

There is a specimen of this plant in Herb. Paris to which Naudin has attached a note "E. acervula, Sieb.: réuni par Bentham à l'Eucalyptus Stuartiana—espèce doutant."

It is the "Red Gum, *E. acervula*" of Spicer's "Handbook of the Plants of Tasmania," p. 112.

9. *E. Stuartiana*, F.v.M.; Miq. Ned. Kruidk. Arch. iv. 131.

The following extracts from Mueller's writings and notes on some specimens labelled *E. Stuartiana* by Mueller's authority, that I have seen, show the confusion that has gathered around the species. I have not seen Stuart's specimens quoted by Miquel, which were probably *E. Gunnii*, Hook. f., var. *acervula*, Deane and Maiden. I have suggested in my paper "On *E. Stuartiana*, F.v.M." that it would be an advantage to botanical science if the name *E. Stuartiana*, F.v.M., could be swept out of existence. But since this is impossible, I have, after patiently examining the subject for many years, recommended that *E. Stuartiana*, F.v.M., should be recognised as the name of the "Apple or But But" so widely diffused in New South Wales and Gippsland, and which is one of the forms labelled "*E. Stuartiana*, F.v.M.," by Mueller himself an enormous number of times. The revision of a botanical name has taken place in Europe in a number of well known instances, to the advantage of nomenclature.

The following specimens in Herb. Melb. belong to *E. Gunnii*, var. *acervula*, and were at one time labelled *E. Stuartiana by* Mueller.

a. "White Gum of Mt. Macedon, F. Mueller 1852."

b. An identical specimen from "Barwon, 1853," has the label "*E. Stuartiana*, formerly labelled *E. Gunnii*," showing that Mueller labelled the plant *Gunnii*, then *Stuartiana* (and finally *Gunnii*).

c. Bullarook Ranges, Ballarat.

d. Curdie's Inlet, 1874.

"*E. Stuartiana*, one of the white gum-trees. In moist localities, as well in plains as ranges. A tree of an enormous size in Victoria, perhaps only surpassed by the *Eucalyptus amygdalina* and the Karri Eucalypt of West Australia (*E. diversicolor* or *E. colossea*)." (Mueller in Official Record, Intercol. Exhib. Melb. 1866-7, p. 222).

"One of the White Gum trees of the eastern parts of South Australia, Victoria, Tasmania and the south of New South Wales; called, strange to say, the Apple-tree about Dandenong; the Water Gum-tree of Tasmania may belong to the same species; it is designated locally with still other names. The bark of this often very big tree furnishes good material for packing paper, and, like others, for paste board" (*ib.* p. 246).

Following are specimens which were collected by Oldfield. They are labelled :—

a. "*E. Stuartiana*, 'Red Gum,' Jericho, Tasmania."

b. "Hill near Lake Tiberias, Tasmania"; the suckers of this specimen are labelled *E. viminalis*.

c. O'Brien's Bridge, Tasmania."

All these specimens agree, in every particular, with *E. Gunnii*, Hook. f. var. *acervula*.

"*E. Stuartiana*, F.v.M., Marshall's Plains, Flinders' Island. A. Simson (573), June 1877" (W. W. Spicer in herb. Oxon.).

In the Tasmanian Court of the Melbourne Exhibition, 1888, were shown "Red Gum" sleepers ("*E. Stuartiana*") from Rhyndaston, belonging to the Tasmanian Government Railways.

In R. M. Johnston's "Tasmanian Official Record," 1891, p. 136, the following passage occurs:—

"Red Gum, *E. Stuartiana*, Muell. This tree is common near Southport, but more widely distributed in the south-eastern ranges of Australia. When well grown it attains a middle size, seldom reaching 100 ft. in height. Stems oftener twisted than straight. The wood is stated to be hard, but does not split well: it is used for fence posts, and it is then very durable; sometimes used for rough kinds of furniture, as it takes polish well. It is known as 'But But' in Gippsland."

It is evident from this that the timber of *E. Gunnii*, var. *acervula*, is more valued in Tasmania than on the mainland; the erroneous allusion to "But But" will be understood on reference to *E. Stuartiana*, p. 556.

10. *E. Gunnii*, F.v.M., Fragm. ii. 62.

This is not typical *Gunnii*, Hook. f., but the Red Gum of Tasmania (*E. Gunnii*, Hook. f. var. *acervula*, Deane and Maiden). At the time that Mueller wrote his description, Hooker's Flora Tasm. had not come into his hands, and he gave his interpretation of *E. Gunnii*.

It is clear what Mueller's plant is, from the description, but the matter is set at rest by a specimen (which is *E. Gunnii*, var. *acervula*) in Herb. Kew, and which bears the label "*E. Gunnii*" in Mueller's handwriting, with *E. Stuartiana*, Miq., and *E. Baueriana*, Miq., as synonyms.

11. *E. undulata*, Oldfield, collected by him and in his handwriting in herb. Vindob. It is var. *acervula*. I do not know if he described his variety.

E. Gunnii, Hook. f. var. *elata*, Hook. f. See below, p. 588.

RANGE.

Tasmania.—For convenience I place the following specimens under var. *acervula*, but I repeat that I find it impossible to separate *E. Gunnii* from its variety in many cases. Southport, 1900 ft. (Charles Stuart).

Swanport (Dr. Story). "On flat ground with other scrub on top of rocky hills" (Dr. Story, in herb. Melb.). With leaves nearly ovate and with a mucro. I have identical specimens from the vicinity of Hobart from Mr. Rodway, who looks upon them as typical of *Gunnii*. In my view they are intermediate between *Gunnii* and var. *acervula*.

"Black Gum," Eastern marshes; also west of Cockatoo Valley (T. Stephens); "Swamp Gum, growing in swampy places" (various collectors); North West Bay (Cresswell); Richmond Road; Kingston; Muddy Plains (Rodway); Mt. Wellington (A. H. S. Lucas); River Derwent (Abbott).

"One about 40 yards from the biggest was 60 ft. at 4 ft. from the ground and at 130 must have been fully 40 ft. in circumference; it was without buttresses, but went up one solid massive column, without the least symptom of decay. . . . . The largest we measured was, at 3 ft. from the ground, 102 ft. in circumference, and at the ground 130 ft. We had no means of estimating its height, so dense was the neighbouring forest, above which, however, it towered in majestic grandeur. This noble Swamp Gum is still growing (1849) and shows no signs of decay" (Rev. T. J. Ewing in Papers and Proc. R.S. Van Diemen's Land, i. 165, 1851).

The above magnificent trees were in the vicinity of the North West Bay River, and if correctly described as Swamp Gum are probably *E. Gunnii*, var. *acervula*.

Victoria.—"*E. Stuartiana*" (original label) Bullarook Ranges; Ballarat.

"*E. Stuartiana*," Curdie's Inlet, March 1874.

"*E. Stuartiana*," Mt. Macedon, 1852, Mueller. The above in herb. Melb. Goulburn River, 1853; very large leaves; near var. *ovata*.

Anderson's Creek, "Lowland form." "Swamp Gum" Dandenong Ranges (D. Boyle).

Branxholme (D. McAlpine, 1889), determined by Mueller in in connection with McAlpine's paper on petiole sections (Trans. R. Soc. Vict. 1890).

Mt. Juliette, 4,000 ft. Trees 150 ft.

Following are specimens from Mr. A. W. Howitt, mostly from Gippsland localities:—

South Gippsland; "Swamp Gum," Gippsland; "Swamp Gum," banks of Latrobe River; "Swamp Gum" on clay flats, Traralgon; "Swamp Gum," Stratford (transit to var. *rubida*); Alberton; Stony Creek, Dargo; Reedy Flat; Hubert's Corner; Upper Yarra; "Swamp Blue Gum," Lilydale.

"Forms the whole of the forests in scattered trees from Branxholme to Hotspur. Swamp Gum, used for posts. Inferior. Lasts 20-25 years;" East Malvern, Melbourne.

Mr. Howitt says:—"The Swamp Gum" (*E. Gunnii*) grows in most parts of Victoria in creeks and swampy flats of mountainous districts and in Gippsland. At Warragul I saw it some years back cut for sale under the name of "Blue Gum." It is one of the most worthless of our timbers."

South Australia.—See below, pp. 586-588.

New South Wales.—"White Gum" (No. 2 of my notes) Brown's Camp, Delegate (W. Bäuerlen). Quite glabrous, many-flowered, operculum conical; nearly ripe fruit available; young leaves oblong-cordate, quite glabrous.

Delegate River. Bark deciduous. W. Bäuerlen's No. 217, May 1889.

"Red Gum," Bombala. Bark deciduous (W. Bäuerlen, January 1887).

Delegate to Bombala. Shiny leaves, undulate (H. Deane and J.H.M.).

Near Cathcart (H. Deane and J.H.M.). Very broad, leathery leaves, lanceolate, up to four or five inches long; quite glabrous, both leaves and fruit.

"Hickory," Twofold Bay (Lockhart Morton). "One of the largest trees of these parts."

"Cabbage Gum" Nimbo Station, head of Queanbeyan River (H. Deane). "Flooded Gum" Queanbeyan (Mr. Deane's No. 413). Both these specimens are identical with the Twofold Bay tree.

Charley's Forest, Braidwood (W. Bäuerlen). One of Mr. Baker's type-specimens of *E. paludosa.*

"Grey Gum," Bowning, on flats (A. Murphy), very similar to the Charley's Forest specimens. Some of the fruits display a tendency to *goniocalyx.*

"Creek Gum," Marulan (A. Murphy). "Yellow Gum," Barber's Creek (H. Rumsey); Wingello (J.H.M.).

"Yellow Gum, on flats, Bowral to Goulburn" (W. Woolls).

"Flooded or Ribbony Gum," Shepherd's Swamp, Hill Top (J.H.M.).

On the Lowther Road, Mt. Victoria, we have interesting specimens collected off the same tree, the series being most instructive. A pendulous Ribbony Gum. Suckers those of normal *Gunnii.* Fruits conoid and domed; shiny buds, multiflowered; a combination of normal *Gunnii* and vars. *acervula* and *maculosa* (*infra*). Contemplation of a tree like this shows that it is impossible to separate varieties *acervula* and *maculosa* from the normal species. White Gum specimens from Mt. Victoria have the fruits somewhat like var. *maculosa*, but not so domed, and more conoid. The fruits also have some resemblance to var. *rubida*, but are multiflowered.

At Fairy Dell and other parts of Mt. Victoria there is "Swamp Gum" in abundance, with undulating leaves, which are sometimes very long, and with broad suckers. Buds shiny. The fruits in the unripe state have the truncate appearance so commonly seen in Victoria, South Australia, and other parts of New South Wales. The resemblance to var. *maculosa* is obvious.

"No. 129. Bark very smooth and white. New England (Charles Stuart). Linear-lanceolar leaves. Buds pointed, up to fours; small fruits.

Placed by Bentham with *E. viminalis*, but I think it is a form of *Gunnii* lying between vars. *acervula* and *rubida.*

"No. 460, Charles Stuart, Timbarra, N.S.W. 40-50 ft., bark white, smooth, separating in thin laminæ. Tree much branched." Multiflowered. Bentham places this with *E. viminalis*, but I think it rather belongs to *E. Gunnii*, and for the present I place it between vars. *acervula* and *rubida*.

"White Gum," Koolah Station. Collected by Leichhardt and labelled *E. viminalis* by Bentham. I have some doubts that these Queensland specimens may be referable to *E. Gunnii* (between vars. *acervula* and *rubida*), like Northern New South Wales specimens collected by Charles Stuart.

Where no information is available in regard to the bark, it is possible that a multiflowered form of *E. Gunnii* may be mistaken for *E. pulverulenta* (lanceolar form) in Northern New South Wales and Queensland.

B.—var. *ovata*, Deane and Maiden (these Proceedings, xxvi., 136).

N.B.—It is quite impossible to separate var. *ovata* from var. *acervula* in many cases.

SYNONYMS.

1. *E. ovata*, Labill., Nov. Holl. Pl. Sp. ii. 13, t. 153 (with description).

In this plate the artist Redouté has exaggerated the crenulation of the leaf-margins. He has committed a similar fault in the figure of *E. cordata*, Labill.

Labilladière says "In terra Van Leuwin," a slip of the pen for "Van Diemen." Bentham, however, assuming that the locality is Cape Leeuwin, says (B.Fl. iii. 200) . . . . "from West Australia; does not occur in the distributed sets of Labillardière's plants I have seen. From the figure it appears probable that the specimen represented was an adventitious branch, with much broader leaves than the ordinary flowering ones. It is very likely, therefore, a form of some one of the described western species, possibly *E. brachypoda*."

I have, however, (1900) seen a specimen of *E. ovata*, Labill., in Herb. Kew. It has ovate and sometimes retuse leaves, and the fruits are conical. It is one of the innumerable forms between var. *acervula* and var. *ovata* (*E. camphora*, R. T. Baker) which connect the whole with *E. Gunnii*.

2. *E. androsemæfolia*, Hoffmg., Verz. Pfl. Nachtr. ii. 113.

"E. foliis ovatis ovatove-oblongis obtusiusculis subapiculatis glaucescentibus subtus glaucis, inferioribus oppositis subcordatis, superioribus petiolatis alternis. Hab. in Austral.

"Folia, hucusque non obliqua, similia magnis quibusdam et latis Hypericorum, ita ut *E. hypericifoliam* putassem, nisi mensura, 2′-2′ 6″ lg. ut summum 1′ 6″ lt. ab eâ in Link. Enum. datâ, nimis diferret. An forte *E. ovata*, Lab. (Steud.)."

I have not seen this species. Bentham says it is very doubtful, De Candolle (Prod. iii. 218) says that it is a synonym of *E. ovata*, Labill.

3. *E. mucronata*, Link, Enum. Hort. Berol. ii. 30, is described as follows from leaf only :—

"220. *E. mucronata*. Fol. pet. 6″ longo, lamina lanceolata acumine brevem mucronem referente subundulata subtus nervis parallelis, utrinque nerva marginali, 3-4′ longa 1-2′ lata basi subovata variæ magnitudinis. Hab. in Australia. Non floruit." Bentham says this is very doubtful. De Candolle (Prod. iii. 218) gives it as a synonym of *E. ovata*, Labill.

RANGE.

Victoria.—"Falck's timber specimen No. 13, Aug. 1879," from Beechworth.

Bright district "Swamp Gum" (J.H.M.).

"Tall form *E. Gunnii*," Upper Livingstone Creek, Gippsland (A. W. Howitt),

Goulburn River. 1853. Very broad leaves, fruits not available (Mueller).

New South Wales.—Bombala (W. Bäuerlen, No. 556). Mr. Baker says that this is his *E. camphora*, but I cannot distinguish it from var. *acervula*. It is one of the many specimens which connect the varieties *acervula* and *ovata*.

Brown's Camp, Delegate, and "Bastard or Flooded Gum," Delegate (both W. Bäuerlen). I many years ago labelled these Delegate specimens "Highland form of *E. Gunnii*;" conical, very exserted fruits; very pointed operculum; large broad thickish leaves."

Tumberumba (H. Deane).

"Broad leaved Sally," Cockatoo, near Germanton (W. Forsyth).

Nullo Mountain, Rylstone (R. T. Baker).

C.—Var. *rubida*, var.nov. (Syn. *E. rubida*, Deane and Maiden, these Proceedings, xxv. 456).

There are connecting links between the normally multiflowered variety *acervula* and the normally three-flowered variety *rubida*. Leaves, buds, fruits are all variable. Instances of this variation have been given already; additional ones will be cited.

I have observed var. *rubida*, *e.g.* at Wallerawang, with hard, black bark for 10 feet up At other times it is ribbony right up the trunk and all over. I cannot tell the difference, in the field, in some districts, between it and typical *Gunnii* except by botanical examination. Normally var. *rubida* is a White Gum.

1. *E. granularis*, Sieb

Bentham (B Fl. iii. 240) refers this to *E. viminalis*. No description of it was ever published (Mueller, in Eucalyptographia under *E. viminalis*).

A specimen in Herb. Melb. collected by Mueller in 1853 at Fifteen Mile Creek, Victoria, and labelled by him "*E. granularis*, Sieb., *E. viminalis*, Labill., var. *granularis*, F.v.M." This specimen is in bud only (in threes) and is *E. rubida*. I have not seen an original of Sieber's.

2. *E. Gunnii*, Miq.

Following is the reference in Ned. Kruidk. Arch. iv. (1856), 126:—"8. *Eucalyptus Gunnii*, J. D. Hook., Lond. Journ. Bot. iii. p. 499. Strzlecki-range (F. Mueller). Forma normalis exstat et alia abludens umbellis 5-floris."

I have seen the type in Herb. Kew, and exhibit a drawing of it (4 flowers). It comes nearest to var. *rubida*, but shows transit to var. *acervula*.

RANGE.

Tasmania.—Swanport (Dr. Story). Similar to specimens from Capertee, N.S W. Multiflowered, with narrow leaves and small fruits. A form lying between vars. *acervula* and *rubida*.

Victoria.—Eltham near Melbourne, "White Gum"; Anderson's Creek, "*E. viminalis*, but may be *E. Stuartiana*, var." (F.v.M.'s note); Fifteen Mile Creek, Mueller, 1853, labelled by him "*E. viminalis*, Labill., var. *granularis* (*E. granularis*, Sieb.)."

3. Following refers to Mr. A. W. Howitt's *E. viminalis*, var. β:

"The second variety, known as 'Cabbage Gum,' grows specially in the mountains and high alpine regions, where it attains great size. It also occurs north of the Great Dividing Range in the valleys, on rising grounds of the Ovens, Goulburn, and other rivers. This tree has everywhere a deservedly bad name as being easily decayed, but it might possibly, where other timber is scarce, be used under some other name."

The following specimens of the above have been kindly communicated by Mr. Howitt:—Grant (W. H. Morgan); Squirrel Forest; Dargo; Monsell; "Cabbage Gum," Woorgellong (O'Rourke); Watertee and Beaufort; Macedon; Bullarte; Benalla; "Cabbage Gum," Blanket Creek; Eight Mile Swamp, Port Road; Alexandra Road; Orr's Creek; (?) "Eirich Swamp Creek, on road from Tubbutt to Delegate, N.S.W., bole and limbs very white as if whitewashed, seedlings have opposed rounded leaves" (A. W. Howitt, No. 149).

The following are multiflowered forms, but nearest to var. *rubida*:—

Asylum, Beechworth (A. W. Howitt).

"Buds very commonly 7 or less — *E. viminalis*, Walhalla Road" (A. W. Howitt), shows transit to var. *acervula*.

Howitt's *viminalis* var., Tarra Ranges and Ararat (A. W. Howitt). Same as preceding.

"*Euc. viminalis*, transit to *Stuartiana*, Beechworth (Falck)." Fruits more pear-shaped and domed than usual. Multiflowered as regards buds; the fruiting specimens in threes. The buds are pointed and the tree seems nearest to var. *rubida*.

I have seen multiflowered specimens, with unusually small leaves, from the Dandenong (Gessner).

Ringwood (R. H. Cambage).

"*Euc. Stuartiana*, formerly labelled *Gunnii*, Barwon, 1853" (Mueller).

Warrandyte, 1880 (C. Walter).

Both the latter multiflowered and nearest to var. *rubida*, but connecting with var. *acervula*.

I have collected a multiflowered form (5's) at Bright in Victoria. Otherwise it is typical, and the venation strongly marked like *E. Gunnii* from New England.

South Australia.—See below, pp. 587-588.

New South Wales.—Mt. Kosciusko (lower slopes) and Jindabyne (J.H.M.).

Mrs. John (afterwards Lady) Hay exhibited at the Paris Exhibition of 1855 some manna from a tree from the Upper Murray, which I believe to be var. *rubida*. She states, "It is found in considerable quantities in many tracts, generally rather upland, scattered under the trees from which it exudes. The tree has a white bark streaked with red, which shells off annually. The manna falls in March and April. The trees are called by the blacks Bak Bak."

Adaminaby to Cooma (E. Betche).

"White Gum" No. 3 of my notes. Brown's Camp, Delegate (W. Bäuerlen). In 3's. Between the type and var. *rubida*.

Yellowish smooth bark, a little ribbony. Delegate-Bombala (H. Deane and J.H.M.).

Bombala (J.H.M.). Mr. Ronald Campbell, of Cambalong, says it is the common "Spotted Gum" of the Monaro. It is an entirely valueless timber. It usually has a clean stem for a considerable distance up. I was informed that stock are very fond of the leaves; collateral evidence of its affinity to *E. Gunnii*.

Quiedong (W. Bäuerlen); Michelago (H. Deane).

Braidwood district, also Monga near Braidwood (W. Bäuerlen).

"Flooded Gum," Rob Roy and Queanbeyan (H. Deane); "Spotted Gum," Queanbeyan, connecting with var. *maculosa* (H. Deane); "Candle-bark," Queanbeyan (H. Deane).

"No. 6, smooth yellow bark, rough near ground, Wingello; Louisa Calvert" (about 1864). Mueller's note, "Record of bark probably erroneous, *E. Stuartiana*."

White Gum, Miss Atkinson, Berrima, Herb. Melb.

Both of these are multiflowered. Perhaps they are nearer var. *maculosa*, but the fruits are more of the shape of var. *rubida*, an additional evidence of the impossibility of separating the two forms.

"Cabbage Gum," Marulan (A. Murphy), with smaller fruits than usual in 3's and glaucous.

"Red Gum," Wingello (A. Murphy).

'Yellow Gum," Barber's Creek and Wingello, including Paddy's River (J.H.M.).

Mt. Victoria, Lowther Road, Kanimbla Valley (J.H.M.).

Jenolan Caves (J.H.M.). Very broad leaves. In 3's. "Cabbage Gum," bark very smooth and patchy; colours slaty-blue and white. This is between the type and var. *rubida*.

At Wallerawang var. *rubida* is a *viminalis*-looking tree, rather drooping and with ragged ribbony bark. On flats var. *rubida* has very red and ribbony bark here, and there is no doubt that the description of *rubida* must be modified as to the bark. It is not smooth in all localities, but ribbony sometimes. In this locality it would not be taken for a "White Gum." It is either a ribbony (or even densely ribbony) Gum, with a rough *saligna*-like or even scaly bark at butt and a red patched trunk. In some places in the district it is more a White Gum, but in drier localities. It sometimes has manna on it.

In the Capertee Valley var. *rubida* has flowers in 3's and with yellowish pointed buds. At Capertee I found several typical trees with several flowers in 4's and a few in 5's. Further examination of trees in some other parts of the State shows that (like normal *viminalis*), the normal variety *rubida* has usually flowers in 3's, but not constantly so.

When the buds are taken from a dead branch they have a shiny appearance, and are of a pinkish or pale red colour, not easily described, but apparently a useful character for classification purposes.

I observed var. *rubida* and *E. viminalis* growing alongside at Ben Bullen, Mudgee line. Both have ribbony trunks and the colouration of the trunks and the habit of the trees are exactly the same. I can find no difference between them except of a botanical character.

"Ribbony Gum"; large trees on flats. Distinguished from Red Gum (*tereticornis*) by the ribbony base and the cleaner grain of the timber. Base of stem of a bluish colour, with patches of a darker green. Wattle Flat, Sunny Corner (J. L. Boorman). In 3's. A coarse form of *rubida*.

" Blue Gum," "Drooping Gum," Tarana (A. Murphy).

Rockley Road, Bathurst (R. H. Cambage).

Top of Canoblas, Orange. Very glaucous. Not really different from the type.

Blayney, glaucous (J.H.M.).

Little River near Burraga (R. H. Cambage).

D.—Var. *maculosa*, var.nov. (Syn. *E. maculosa*, R. T. Baker, these Proceedings, xxiv. 598).

I have had this variety under observation since 1886, and in March, 1889, I first drew Mr. Baker's attention to it. For some time I looked upon it as a form of *viminalis*, and it bore the name *viminalis multiflora* in manuscript. I do not doubt that it is a form of *Gunnii*, and Mr. Baker's specific name of *maculosa* may be adopted for the variety. The bark is patchy, like *E. tereticornis* and also ribbony or ribbony-scaly right up to the first fork. Rough ribbony like *E. viminalis*, *E. Gunnii* and var. *rubida* often are.

In dry situations it is often difficult to discriminate between it and var. *rubida*. I have, on several occasions, had tall trees cut down in order to discover which form they were.

The term "Spotted Gum" appears characteristic enough in many places, but we have intermediate forms. It is called "Bastard White Gum," "Spotted Gum," "Cabbage Gum," and a variety of names.

It is found in many parts of the State and Victoria, particularly in cold, mountainous districts, usually on hill sides and less frequently by the side of streams. In its typical form it occurs on dry slopes and ridges; in moist situations it approximates to the normal form, and hence usually escapes separate notice.

By the non-botanist the Spotted-Gum-form (*i.e.*, that growing in dry situations) is usually confused with the common White Gum (*E. hæmastoma*), but it belongs to the Parallantheræ. Mr. R. H. Cambage has obligingly written the following comparison of the two trees, as he knows them, from Mt. Victoria to Burraga, Ophir, Orange, &c. He calls it "White Brittle Gum," and *E. hæmastoma*, var. *micrantha*, "Red Brittle Gum."

"This tree has various names in different localities. At Wiseman's Creek, near Bathurst, it is called 'White Cabbage Gum,' while at Ophir, near Orange, some miners give it the name of 'Spotted Gum,' as it loses its bark in small patches, which have a yellowish tint, but are not so distinctive as *E. maculata*. 'White Brittle Gum' is a very general name.

"By a casual observer this tree would be confused with *E. hæmastoma*, and in general appearance it very much resembles it. When seen growing together it will be noticed that the White Brittle Gum is *whiter* in the bark than *E. hæmastoma*, the former often being covered with a white powder; hence another name for it is 'White Floury Gum,' which I have heard used.

"The fruits of White Brittle Gum are more sessile and domed. The leaves are not so brittle as those of *E. hæmastoma*, and the difference can be detected by biting them. I have seen this experimented on by mixing the leaves of both trees and then having them correctly separated in this way as a test.

"In the Orange and Bathurst districts both trees flourish on hills of Silurian slate, but, generally speaking, *E. hæmastoma* takes the higher land of the two.

"Working miners use both trees for timbering shafts, but for fuel *E. hæmastoma* is preferred, as it burns well when only half dried.

"If there is any doubt as to whether a tree is White Brittle Gum, as *E. hæmastoma* is sometimes called in localities where both trees grow, an axeman who has worked much among them can settle the point by a few blows with the axe, *E. hæmastoma* being the more brittle of the two.

"Around Ophir and Orange the White Brittle Gum seems to flower later than *E. hæmastoma.*"

The foliage is most commonly duller-coloured than that of either *Gunnii* or *viminalis*, but often undulate-leaved, a character rather common in *Gunnii.* Sometimes the whole of the tree (including the bark) is of a glaucous cast, and hence is known by local residents as Slaty Gum, but it is not to be confused with the true Slaty Gum, which is a form of *E. polyanthemos.*

While an extreme form of var. *maculosa* seems distinct enough in the higher parts of the Blue Mountains, it is simply impossible to separate the species from the variety. The suckers are sometimes rather narrow; this would seem to show affinity to *E. viminalis*, and is but additional evidence of the affinity of that species to *E. Gunnii.* We have also specimens from the Southern Ranges that we cannot with certainty place under *E. Gunnii* (typical form) or its var. *maculosa*, though they belong to *E. Gunnii* without doubt. From the Blue Mountains, Barber's Creek, Southern New South Wales, and from various localities in Victoria, we have a form with almost hemispherical calyx, and as large as normal *Gunnii* ever is. The suckers are those of var. *maculosa.*

The affinity of var. *maculosa* is very close to that of var. *acervula.* I have a perfect series of the former from the south (Wingello) and from the west (Mt. Victoria), which shows how very close these relations are, and how impossible it is to remove the two varieties from the same species.

I have specimens (*e.g.*, some labelled "White Brittle Gum" from Mt. Victoria) that I cannot put with var. *maculosa* in preference to var. *acervula* from examination of the specimens. I simply place them with var. *maculosa* because, from my knowledge of the locality, they come from trees named *E. maculosa*.

I have already referred to the fact that vars. *rubida* and *maculosa* are very closely related, even identical. It is impossible to separate them.

The fruits in some districts are of precisely the same size, and in no place is there much difference in this respect. Usually var. *rubida* has the flowers in 3's, while var. *maculosa* is multiflowered, a ready test, but one which often breaks down.

RANGE.

New South Wales.—Bungendore (W. Bäuerlen), "Spotted Gum." Type of Mr. Baker's *maculosa*, var. A.

Charley's Forest, Braidwood (W. Bäuerlen). "Spotted Gum" or "Leopard Gum" of Queanbeyan also intermediate between var. *rubida* and *maculosa*, or perhaps it is var. *maculosa* entirely. This tree at Queanbeyan is one of a group called "Spotted Gum." My informant calls it "Leopard Spotted Gum." The bark is smooth, and the small irregular reddish patches give it the name. On dry hilly ground; timber bad (H. Deane, April, 1886.)

I have a fine series from Wingello. These specimens show well in buds, young and mature fruits and foliage, the close relation of var. *maculosa* to the type, its closest affinity being to var. *acervula*.

The following notes on two trees in the Goulburn district were made in the field in August. Although differing slightly between themselves they belong to this variety:—(*a*) Fruits conoid when young, very much domed when old; in 3's up to 7's, pedicels thick; wood reddish; young twigs angular. (*b*) Flowers profusely; rarely in 3's, in 4's, 5's, and 6's, rarely more than 6's; usually in 5's; capitate. Leaves usually narrow; venation very prominent. Wood reddish. Yellow tips of young foliage. Stalks round or nearly so; young twigs angular. Fruits small.

A White Gum, also from Marulan (J.H.M.), with plum-coloured bark with blotches. Multiflowered. Between vars. *maculosa* and *acervula*.

A White Gum, Strathdownie, Rosewood, in the Murray Range, 50 miles from Wagga, on the way to Tumberumba (D. McEacharn) has long leaves and approaches var. *maculosa*.

Frederica Falls, Lawson (R. T. Baker). Fruits nearly hemispherical and some of the sucker-leaves rather narrow. One of the stages between var. *acervula* and var. *maculosa*.

Blackheath and Mt. Victoria (J.H.M.). "Cabbage or White Gum," Mt. Wilson (Jesse Gregson and J.H.M.). Bark reddish or brownish. I cannot distinguish these from the Marulan specimens referred to above.

I have a White Gum from Capertee, and other places, with the buds more glaucous and the fruits more hemispherical than usual; in this respect tending towards var. *rubida*.

In some specimens from Capertee, the buds, fruits, &c., are glaucous, as are the Marulan specimens; the suckers are broad, like *Gunnii*. Some of the fruits are as hemispherical as those of var. *rubida* ever are; others are distinctly var. *maculosa*.

Wallerawang and Rydal (J.H.M.). "Cabbage Gum" and "White Gum," Sunny Corner to Tarana (A. Murphy); multiflowered; small fruits precisely matching the Marulan specimens. One of the forms showing the impossibility of separating var. *maculosa* from var. *acervula*. Orange and Ophir (R. H. Cambage). Ilford "Spotted Gum" (Mr. Baker's *E. lactea*). Bathurst and Burraga (R. H Cambage). Oberon Road, O'Connell (Mr. Baker's *E. lactea*)

SUPPLEMENT.

The forms of *E. Gunnii* from the northern part of New South Wales, far from the home of the type, are puzzling, because they do not readily range themselves under described forms. I give a few notes in regard to some specimens, but (with the exception of the first) I do not look upon these determinations as final.

They give some idea of the difficulty of dealing with these aberrant forms.

Ben Lomond, New England (J.H.M.). In 3's. A coarse form common enough in New England, on the Monaro (*e.g.*, Nimitybelle) and elsewhere; comes nearest to var. *rubida*.

The following forms I at present place between var. *acervula* and var. *rubida* :—

"Flooded Gum," Glen Innes (H. Deane); "White Gum," multiflowered, Glen Innes (H. Deane).

Near Bolivia (not far south of Tenterfield) and just west of Dividing Range; also "White Gum" of Cottesbrooke (J.H.M.). Broad suckers, yet a typical Manna Gum; multiflowered. This form occurs at Tenterfield and New England generally. A scrambling tree found on flats.

"White Gum," Gwydir (Leichhardt). In leaf only.

Richmond River, Mrs. Hodgkinson; multiflowered (Herb. Melb.).

The following I place between vars. *acervula* and *maculosa* :—

Trees with perfectly smooth trunk; plum-coloured patches; in a low-lying situation 17 miles east of Walcha (J.H.M.).

"Blue Gum," head waters of the Clarence (F. R. Mecham).

Following are some notes on *E. Gunnii* in South Australia :—

I give some separate notes at this place, as the occurrence of the species in that State requires further investigation.

There is a good figure of a form of the species in Brown's "Forest Flora of South Australia" under the name of "White Swamp Gum." This is multiflowered (up to 6 as shown in the plate), and the fruits are conoid-hemispherical. This form is perhaps nearest to var. *acervula*. It is very common in Mt. Gambier low-lying swamp country (W. Gill).

It is identical with a specimen from Argyle Station, Mt. Gambier, collected by Mueller about 1847, and labelled "*E. viminalis*. Bark thick-scaly (schrundig) at butt." This is the kind of bark shown in Brown's plate; it is not rare in the species, and it is doubtless the "Cortex rimosus nigricanti-cinereus" of *Euc. falci-*

folia, Miq. (*E fabrorum*, F.v.M.) as defined in Ned. Kruidk. Arch. iv. 136 (*infra*).

Dr. Behr's No. 177, "Sud Australie, 1848," is labelled, evidently in a contemporary hand, "*Eucalyptus fabrorum*, Schlect." The specimen is in bud only, and is in Herb. Barbey-Boissier. It has the buds of a pale olive-green colour, such as one oftener sees in *E. Gunnii* (*e.g.*, specimens from Capertee), than in *E. viminalis*. It is difficult to separate specimens in bud like these from *E. viminalis*, but comparing them with *E. Gunnii* from South Australia, I think the specimens probably came from *E. Gunnii*. The matter is not of much consequence, and cannot be settled unless further material is available.

Dr. Behr's specimen above referred to has buds mostly in 3's, but also in 4's. The specimen from Herb. Kew of which I show a figure is labelled "*E. fabrorum*, Schlecht. In mont. ster. elat. Nov. Holl. Austr. Nov. 1848. Dr. F. Müller. Herbar. W. Sonder. *E. viminalis*, Lab., non capitellata," is probably Behr's also. It has buds up to 6.

The following specimen, "Swampy ground near Mt. McIntyre, Mt. Gambier," was formerly labelled *Stuartiana*. It is nearest to var. *rubida*, but not typical of that, inclining to var. *acervula*.

The following specimens from Mr. Walter Gill, Conservator of Forests, S.A., I place with var. *rubida* :—

(*a*) Near Willunga.

(*b*) Near Ambleside Railway Station and other places on the Onkaparinga River; Balhanna. "Yellow Gum," St. Vincent's Gulf (Mueller).

"This tree is of too crooked a growth to be available as a tree to any great extent, and its average height is about thirty feet in South Australia. The wood is hard and of good weight, but it is looked upon by the splitter as of very poor quality for general utilitarian purposes. For posts and underground work the timber is worthless. It, however, makes excellent charcoal" (J. E. Brown). The species has been found to attain a larger size in South Australia than Brown supposed, but further enquiry is desirable. It does not appear to extend to Western Australia.

POSTSCRIPT.—1. Since the above was in type, I have received two excellent series of specimens from Mr. Walter Gill, showing that the varieties *acervula* and *rubida* occur in that State. They came from Kuitpo, Willunga, and confirm the surmises in regard to the South Australian forms given expression to above.

2. Mr. J. G. Luehmann's *E. Kitsoni*, from Southern Victoria, has affinities both with *E. Gunnii*, var. *acervula* and *E. botryoides*.

3. Mr. A. W. Howitt has collected a remarkable form of *E. Gunnii*. "It grows in the swampy places in the upper parts of Livingstone Creek, Gippsland, Victoria, near the Great Dividing Range, about 20 miles from the township. The bark is that of *E. Gunnii*." It has small ovoid buds with double opercula, and the fruits are crowded together in heads of 9 or 10, with valves slightly exserted. The superficial resemblance of this tree (which requires further investigation) to the Western Australian *E. decipiens* is remarkable.

4. *Eucalyptus Gunnii*, Hook. f. var. *montana*, Hook. f. (*Bot. Mag.* t., 7808, December, 1901). I cannot see in what way this supposed variety differs from the normal species.

Var. *elata*, Hook. f. (*loc. cit.*). This is synonymous with var. *acervula*, Deane and Maiden. Hooker's independent enquiries confirm our observations that this is a variety, which it indubitably is (*20th February*, 1902).

THE GUM FERMENTATION OF SUGAR CANE JUICE.

By R. Greig Smith, M.Sc., Macleay Bacteriologist to the Society.

(Plate xxx.)

During the process of manufacturing sugar in the cane-mills, the juice frequently becomes more or less viscous or "gummy," and when this takes place the crystallisation of the sugar is considerably hindered. The "gumming" may occur in the cane juice—the immediate product of the crushed cane—or it may develop at any stage in the manufacture of the raw sugar, especially if the juice or syrup is allowed to cool, or to stand for any length of time. Experience has shown that the only way to minimise the trouble is to complete the crystallisation of the sugar as quickly as possible. The cause of the formation of the gum is not definitely known, although the prevailing idea is that it is developed from something which is contained in the juice.

I received two samples of gummed cane juice from Mr. T. Steel of the Colonial Sugar Company, and was at the same time informed that any information regarding the properties of micro-organisms, which might induce the gummy fermentation of sugar, would be of the greatest economic importance to the sugar manufacturers. Each of the samples consisted of about 5 c.c. of roller cane juice, which had not been treated in any way. One of the samples was viscid; the other appeared limpid, but I was informed that, as compared with normal cane juice, it was decidedly gummy.

The Separation of the Gum-forming Organism.

From the samples several organisms were separated, but none of them produced any apparent viscosity in solutions containing

10 % saccharose, that is to say, the solutions did not become ropy and capable of being drawn into threads as in the case of fluid cultures of many slime-forming organisms. The bacteria were further cultivated in nutrient agar with 20 % saccharose. One of the organisms formed raised transparent mucilaginous colonies, which made it appear probable that it was the most likely organism to produce "gum." This became more probable when short viscous threads were formed on raising the cover from a Petri dish, in which a pure culture had covered the surface of the agar and grown up the rather low side of the dish. A gummy substance had apparently been formed by the bacterium, but since no apparent viscosity had been produced in saccharose fluid media, it was desirable to test the fluid cultures more rigorously for viscosity.

VISCOSITY PRODUCED IN SOLUTIONS OF SACCHAROSE.

With this object in view, an infusion was prepared from 1,000 grms. of grass and 1,000 c.c. of tap water, and to this 200 grms. of cane sugar were added. A 500 c.c. sterile portion was inoculated with the organism and incubated at 28° C., with a check 500 c.c. test. On the third day a viscous film was observed floating upon the surface of the infected medium, and partly adhering to the glass of the culture flask. On the fifth day the culture, with its floating zooglœa films, was boiled, and during the process it was observed to foam very much, as if the solution contained carbon dioxide, while the control test, on being similarly treated, boiled quietly. Both fluids were then filtered through paper; the culture filtered slowly, and the zooglœa films were retained on the filter. The fluids were brought to a uniform temperature (24° C., the air temperature being 22° C.). and allowed to run from a 100 c.c. pipette, provided with a narrow outlet, and having two marks on the stem, one above and the other below the bulb. The time taken by the surface of the fluids in passing from the upper to the lower mark was noted. For purposes of comparison, the viscosity of other solutions was determined in the same apparatus and at the same temperature.

VISCOSITY OF THE CULTURE COMPARED WITH OTHER SOLUTIONS.

—	Time in Seconds.	Viscosity ratio. Water = 100.
Culture in grass infusion with 20 % sugar, filtered	675	293
Grass infusion with 20 % sugar, filtered... ...	290	126
Grass infusion with 20 % sugar and 2 % dextrin	310	135
Grass infusion with 20 % sugar and 1 % starch, filtered	355	154
Grass infusion with 20 % sugar and 2 % starch, not filtered	625	271
Distilled water	230	100

It is at once evident that the organism has produced a decided viscosity in the liquid medium, and had the culture not been filtered, the viscosity would have been greater. The organism is, therefore, capable of producing a viscous substance in nutrient solutions containing cane sugar.

The bacterium was subsequently grown in a saline medium containing 10 % saccharose and 0·1 % peptone. The viscosity of a three weeks' culture was determined, but the temperature was lower (18° C.), and the apparatus was probably different from that used before, although the volume was about the same, viz., 100 c.c.

—	Time in Seconds.	Viscosity Ratio.
Three weeks' culture at 37° C.	530	189
Culture medium	303	108
Distilled water	280	100

THE NATURE OF THE VISCOUS SUBSTANCE.

To obtain some idea of the nature of the viscous substance, a portion of the filtered culture was treated with alcohol, when amorphous flakes were precipitated. These adhered tenaciously to the glass vessel in which the precipitation was conducted, and were easily washed with fresh alcohol. When treated with water the flakes appeared to partly dissolve and partly swell up ; on boiling, an apparent solution was obtained. The gum was precipitated by alcohol, and redissolved in water several times until a comparatively white precipitate, free from sugar, was obtained. The aqueous solution was easily precipitated by alcohol.

On warming with dilute tartaric acid, a reducible sugar was formed (saccharose treated similarly was not inverted). These tests show that the viscous substance is of the nature of dextran or fermentation gum, but the identification was deferred until a greater quantity had been prepared from a medium containing a more definite substance than grass infusion, some of the carbohydrates of which would be precipitated with the gum.

THE FERMENTATION OF SACCHAROSE.

The action of the organism, which had by this time been found to be a sporulating rod or bacillus, is of considerable importance, for it appears to be an undoubted fact that the gum is formed from the sugar. There may, also, be a further loss of saccharose from the formation of hexoses, if the organism secretes invertase. To test these points, a culture medium containing the following constituents was prepared.

Saccharose	100 grm.
Potassium chloride	5 ,,
Sodium phosphate	2 ,,
Peptone	1 ,,
Tap water	1000 c.c.

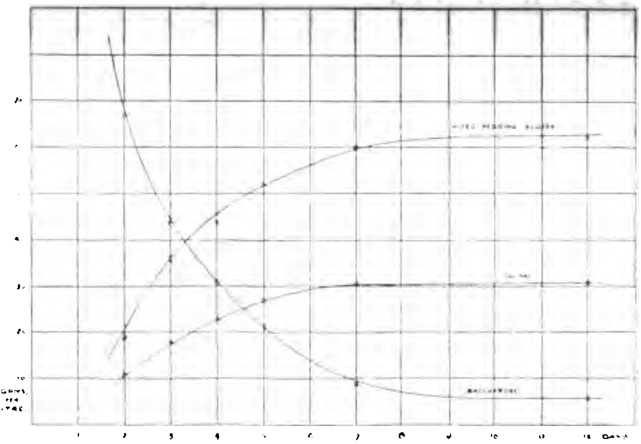
Sterile litre portions of this medium were infected with large loops of an agar culture of the bacillus, and incubated at 22°, 28° and 37° C. respectively. The cultures soon became white and opalescent like dilute separated milk. A thin film formed on the surface, and when the flasks were allowed to stand without shaking, a layer about a centimetre thick of a mucilaginous or starch paste-like substance formed at the bottom of the liquid. When this was removed by continued shaking, it remained suspended in the milky medium. The layer, when undisturbed, disappeared on continued incubation. The culture fluid contained gum, unaltered saccharose, and a reducing sugar or mixture of sugars. A small quantity of acid was also formed. In estimating the sugars, it is necessary to remove the gum, and to do this various precipitants or coagulants were tried. Basic acetate of lead was found to be useless, as a diffuse emulsion was formed which refused to coagulate. The addition of milk of lime to the lead emulsion produced coagulation, but an equally good coagulation was obtained by the use of milk of lime alone. Lime is not an ideal coagulant on account of the possible formation of difficultly soluble compounds with the sugars, especially with levulose. The percentages of saccharose inverted and not inverted might not, therefore, be a true index of the rate of change when lime is employed, and a number of analyses bore out this contention. A coagulation of the gum was also attempted with anhydrous magnesium sulphate and with calcined magnesia, but these magnesium compounds were found to be quite inert—no coagulation was obtained, and the filtrate appeared similar to the solution before the addition. Acid mercuric nitrate, like basic lead acetate, formed a diffuse emulsion which passed slowly and without retention through filter paper. The neutralisation of the acid with sodium hydrate, until the emulsion became yellowish, was also without effect.

The only safe coagulant appears to be alcohol, and in the following work upon the action of the bacillus this was used. After many trials the following method was adopted. Twenty c.c. of the culture is slowly dropped into 60 c.c. of strong alcohol (methylated spirit distilling at 77·5 - 78·5° C.) while the latter is being vigorously stirred. A drop of phenolphthalein solution is next added, and the acidity neutralised with dilute sodium hydrate. Finally 20 to 40 c.c. of alcohol are added to make certain that coagulation has been complete. After standing for two or three hours, the gum is filtered off upon a dry and tared filter and scraped from the beaker, to which it adheres somewhat firmly. If necessary, the adhering particles are treated with a small quantity of hot water, the gum precipitated with excess of alcohol and filtered. The gum is dried at 100° C. until of constant weight, and finally the ash is determined. On subtracting the ash from the dried gum, the amount of crude gum in the portion taken is obtained. The alcohol is distilled off from the sugars, which are estimated volumetrically before and after inversion with hydrochloric acid at 70° C.

The following table shows the progressive formation of gum and mixed reducing sugars in the dilute peptone solution. The percentages are given to the nearest whole number.

THE FERMENTATION OF SACCHAROSE AT 37° C. IN A SOLUTION CONTAINING 100 GRMS. SACCHAROSE, 1 GRM. PEPTONE AND SALTS PER LITRE.

Time in days	0	2	3	4	5	7	12
Saccharose	100	67	44	31	21	9	6
Mixed reducing sugars ..	—	19	36	44	52	60	62
Crude gum	—	11	18	23	27	31	31



CURVES SHOWING THE LOSS OF SACCHAROSE AND FORMATION OF GUM AND INVERT SUGAR

The formation of gum and the inversion of the sugar are seen to go on steadily from the second day until a balance is practically established between the constituents on the seventh day. The saccharose is not entirely inverted, nor is this to be expected. Marshall Ward and Reynolds Green* found a complete inversion of saccharose with their sugar bacteria, but it is just possible that this was brought about by the acid fluids (their organism produced in the culture fluid 0·7 % acetic and 0·057 % succinic acids) during the chemical manipulation and not by the invertase secreted by the organism. Even with the small amount of acid in my cultures I noted in my preliminary experiments an increase in the invert sugar when the acids were not neutralised. The acids formed by the bacillus have also a solvent action upon the gum. In one case I obtained 31 grms. per litre of crude gum as against 29 grms. when the acidity was not neutralised during the precipitation with alcohol.

THE INFLUENCE OF VARYING AMOUNTS OF PEPTONE.

The bacillus can grow with marked action upon saccharose in exceedingly poor nutrient solutions. The solutions in which the action has been already shown contained only $\frac{1}{10}$ % of peptone. With smaller amounts the formation of gum is evident from the appearance of the cultures, although the action is naturally not so rapid. With the object of determining the influence of peptone on the fermentation, a series of cultures containing varying amounts of peptone, but with the other constituents as before, were made and analysed upon the same, viz., the fifth, day. The results expressed in terms of 100 parts of original saccharose, i.e., in parts per litre of culture fluid, are given in the table, and are also plotted upon the curves that follow.

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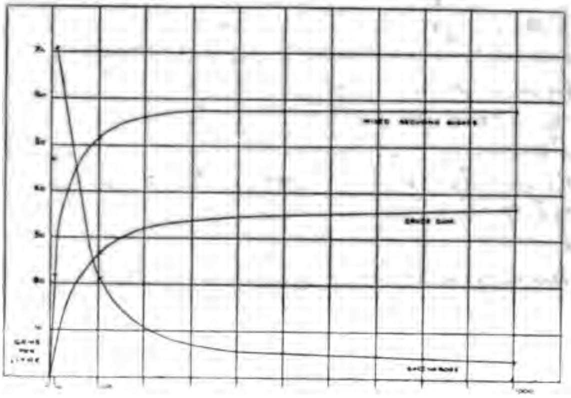
* Ward and Green, *Proc. Roy. Soc.* lxv., No. 414, 79.

THE FERMENTATION OF SACCHAROSE WITH VARYING PERCENTAGES OF PEPTONE.

——	Percentage of peptone in culture fluid.				
	None.	0·001	0·01	0·1*	1·0
Saccharose...	99†	97	71	21	4
Mixed Reducing Sugars	0·5‡	2	23	52	58
Crude Gum	0·4	1	6	27	37
Acidity as lactic acid in 100 c.c. of culture	None	0·002	0·03	0·08§	0·18



PEPTONE IN MILLIGRAMS PER CENT.

It is evident from these results that the fermentative activity is considerably influenced by the presence of peptone. But although an increase of growth was expected from an increase of peptone the relative formation of gum and mixed reducing sugars could not have been foretold. With increasing amounts of peptone there is proportionately more gum than reducing sugars formed, there is more saccharose fermented and more acid formed. With no peptone and with 0·001 % peptone the changes are too small to enable any deduction to be made. The influence of the peptone on the formation of gum is better seen on comparing the amounts formed in 0·01 % and 1·0 % solutions; in the former the ratio of gum to reducing sugars is 1 : 3·8, while in the latter it is 1 : 1·6. But since it is probable that the gum is formed from the sugar inverted, we might calculate the ratio between the gum and the sugar wholly inverted, *i.e.*, the saccharose which has disappeared calculated to hexose. With 0·01 % peptone this ratio is 1 : 5·1, and with 1·0 % it is 1 : 2·7. So that in whatever way we look at these two columns we find that an increase of peptone gives an increase of gum and a relative decrease of hexoses, and conversely, with decreasing amounts of nitrogenous material, there is a decrease of gum and relative increase of reducing sugars.

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* This column is taken from the previous results. † Estimated by difference. ‡ Estimated in the culture directly without previous precipitation of the gum. § Taken from the notes on page 604.

It is to be noted that the original composition of the culture fluid as regards peptone is excellent for the purpose. The best amount would probably be 0·3 or 0·4 %. It was also found incidentally that 10 % of saccharose is about the optimum quantity. With 20 % (and even in the presence of 1 % peptone) the fermentation was far from complete.

THE ACTION UPON OTHER SUGARS.

In testing the action of the bacillus upon other sugars, solutions similar to those already employed, but containing other sugars in place of saccharose, were used. Dextrose was first tested, and media containing commercial starch glucose were infected and cultivated at 37° and 22° respectively. The organisms grew well in the media and produced a turbidity and a flocculent precipitate. The dextrose was estimated from time to time, and the following numbers were obtained:—

PERCENTAGE OF DEXTROSE IN CULTURES OF THE BACILLUS.

Incubation period.	At 37°.	At 22°.
At start	7·5	9·5
1 day	7·4	—
2 days	7·4	—
4 ,, ...	7·4	—
6 ,, ...	7·3	9·4
15 ,, ...	—	9·2

It is apparent that no dextrose has been utilised in the formation of gum, and indeed this was to be expected from the absence of the opalescent appearance which is so marked in the saccharose cultures. A portion of the 15 days' culture at 22° was treated with alcohol when a slight flocculent non-adhesive precipitate was thrown down. This was estimated and found equal to 0·046 %.

Cultures were also made in solutions containing lactose, levulose and maltose respectively. Alcohol did not throw down a precipitate from the lactose culture, but slight loose, flocculent, non-adhesive precipitates similar to that obtained in the glucose culture were precipitated from the media containing levulose and maltose.

From these tests it is apparent that gum is not formed in solutions of the commonly occurring sugars, and this has been the experience of all who have investigated the action of similar saccharose-gum fermenting bacteria.

THE GUM IS PROBABLY THE SWOLLEN OR DIFFLUENT CAPSULE OF THE BACILLUS.

Whether the gum is formed from the sugar by an enzyme extracellularly, or whether it is the diffluent sheath or capsule of the organism, is difficult to prove absolutely. Happ and also, according to Lehmann and Neumann, Ritsert believed that the gum was formed extracellularly, and did not arise from the swelling of the cell membrane, because the swollen capsule could not be demonstrated microscopically. Marshall Ward and Reynolds Green believed that the gum formed by their bacterium was nothing more than the extremely diffluent walls of the cell.

My own observations upon this bacillus lead me to think that the latter hypothesis is probably correct. The gum is the capsule which has dilated so much that it has ceased to be a capsule, and has become a part of the culture fluid. The dilation or swelling is hastened by the excreted acid, which is thus a protection, or rather assistance, to the organism, inasmuch as the growth is accelerated by the removal of what would otherwise be a hindrance to the free movement of the organism. The gum is organic acids, such as acetic, and I have already shown that it is partly soluble in the acids excreted by the cell. An indication of the diffusive action of the excreted acid is seen in the disappearance of the gummy layer at the bottom of resting fluid cultures already mentioned on page 592.

The addition of peptone to a culture fluid, as a rule, causes a numerical increase of the bacteria. If the gum is the diffluent capsule, then the greater the number of bacteria the more gum will probably be formed compared with the other products. As an increase of peptone does increase the percentage of gum actually and relatively, one is justified in concluding that the most probable source of the gum is the capsule.

On staining the cells by the night-blue method, as used for demonstrating flagella, a structure similar to a capsule is manifest. It is possible that the appearance might result from the method of staining, but it is more than probable that the structure is the capsule.

THE CHEMICAL NATURE OF THE GUM.

The gum was precipitated from peptone-saccharose culture by alcohol, and dissolved in water and again precipitated. This was repeated several times, and finally it was allowed to stand under dilute spirit for a week. The gum was then freed from alcohol and tested for reducing sugars. No reduction of Fehling's solution was obtained, and the gum was, therefore, taken as being practically pure. When dried it appears as a pale yellow, partly transparent mass. It forms with water an opalescent semi-solution, and apparently swells up rather than dissolves. From the semi-solution the gum does not separate when allowed to stand for lengthened periods, nor when centrifuged. It does not reduce Fehling's solution, and does not form an osazone with phenylhydrazine. When warmed with dilute sulphuric acid, or with dilute hydrochloric acid, a sugar is produced, which reduces Fehling's solution, and which forms an osazone, having the solubility, appearance and melting point (205°) of glucosazone. The sugar is, therefore, either dextrose, levulose, or a mixture of both these sugars.

Basic lead acetate makes the solution more opaque, but does not coagulate the gum. Lime water gives no precipitate. It has been already shown that it is coagulated by milk of lime, but not by mercuric nitrate, magnesium oxide, or magnesium sulphate. Barium hydrate forms a curdy precipitate, which is decomposed by carbon dioxide. A precipitate is also obtained on adding ammoniacal lead acetate. Dilute sodium hydrate is apparently without effect, but the strong hydrate (10 %) slowly makes the solution clear and limpid. Neither iodine, tannic acid, nor ferric chloride react with solutions of medium strength. When heated in steam for a few hours with dilute nitric acid (2-1), oxalic and tartaric acids are obtained in quantity. Mucic acid is not produced, even when oxidation is effected at lower temperatures.

On heating the dry and powdered gum in capillary tubes, it begins to darken in colour at 160° C. At 183° it shows signs of melting; at 193° the fragments have become soft and adherent, and begin to rise in the capillary tube, apparently the result of decomposition and evolution of water. At 198° the steam bubbles are well marked, and at 200° the gum melts to a transparent brown frothy mass. The brown pyro-substance dissolves readily in water, forming a brown solution like the colour of neutral ferric chloride. It is not precipitated from solution by alcohol at once, although in time a slight sediment settles out. Neither is it precipitated by barium hydrate nor basic lead acetate. It does not reduce Fehling's solution, but reduction is obtained on hydrolysing the body with dilute acids.

The natural gums are substances allied to the carbohydrates; they are of a faintly acid nature and occur combined with alkaline and earthy bases. For example, O'Sullivan has shown that a Gedda gum consists of the calcium, magnesium and potassium salts of four geddic acids.* The gum acids combine with bases to form well defined compounds, the barium one being the most easily prepared.

Following the method recommended by O'Sullivan for the preparation of the gum acid, the bacterial gum was dissolved in

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[illegible]

water and dialysed until free from phosphoric acid after which the faintly acid solution was neutralised with baryta water. A very small quantity (less than 1 c.c.) was required, and the solution appeared to be unaltered and when treated with dilute alcohol did not flocculate. A better result was obtained on adding an excess of baryta water, when there formed a bulky curdy precipitate which rapidly settled. From this behaviour it would appear that the bacterial gum is more nearly related to the starches than to the true gums, such as gum arabic. When no further precipitate was formed the compound was rapidly filtered and washed with water, then with alcohol, until the washings were free from barium. The precipitate was dried *in vacuo* over sulphuric acid, then powdered and finally dried at 100° in a current of dry, CO_2-free air under 100-120 mm. pressure. This method differs from O'Sullivan's in the addition of an excess of baryta water, and it seemed possible that a definite compound might not be formed. To test the matter a sample of gum was divided unequally and each portion was acidified, dialysed, precipitated with excess of baryta water, filtered, washed and dried as described above. The barium in a part of each portion was estimated by precipitation with sulphuric acid and the following results were obtained :—

1st portion—1·4915 grms. gave 0·4505 grm. $BaSO_4$ = 19·84 % BaO.
2nd portion—1·5765 grms. gave 0·4766 grm. $BaSO_4$ = 19·86 % BaO.

These results are very close and undoubtedly prove that when baryta is added in the manner indicated a definite compound is formed. It would also appear that the barium oxide is present in the same proportion as in the compound formed by adding baryta water to starch. Asbóth* found that the starch compound contained 19·97 % BaO, and he considered that this agreed fairly well with the formula $C_{24}H_{40}O_{20}BaO$, which theoretically requires 19·10 % BaO.

THE ORIGIN OF THE GUM.

Marshall Ward and Reynolds Green in discussing the action of a gum bacterium isolated by them considered it possible that the gum, which consisted of a mixture of a dextro-rotatory with an inactive body, might have been derived from the levulose of the inverted saccharose. Boekhout* in investigating the action of *Streptococcus hornensis* found a lævo-rotatory sugar in the residue from the bacterial fermentation and the gum (dextran) produced a dextro-rotatory sugar on hydrolysis. From these facts he concluded that dextrose was the origin of the gum.

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* Asbóth, Analyst, xii., 138.

In determining the origin of the gum it is necessary to test the optical activity of the gum and the amount of the residual sugars after the fermentation. This necessitates the use of a polarimeter, and as I had not that instrument in the laboratory I asked Mr. Steel and he consented to do the necessary determinations from material which I supplied. Mr. Steel was so interested with the gum that he investigated it very fully in the endeavour to identify it, and his results, which confirm and amplify my work upon the gum, are embodied in a paper which is published simultaneously with this. From it I extract a few notes bearing upon the question of the origin of the gum.

The gum is lævorotatory ($A_D = -40°$) and the amount of the residual sugars and of the gum show that the latter is formed from the nascent levulose and also from "something else," because the amount of levulose which has disappeared does not equal the gum that is formed. From this we can only conclude that the "something else" must be dextrose. The fact that the gum is lævorotatory and on hydrolysis yields pure levulose does not conflict with the levulose-dextrose origin of the gum. Much more levulose than dextrose is utilised in its formation, and it is quite conceivable that the optical activity of the major constituent may influence the rotatory power of the derived gum. We can convert dextrose to levulose by forming phenyl-glucosazone, which upon reduction and subsequent treatment with nitrous acid yields levulose. Since this change can be accomplished in the laboratory by the formation of intermediate compounds, there is no reason why a gum which yields pure levulose on hydrolysis should not have been derived in part (or entirely) from dextrose.

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* Boekhout, Cent. f. Bakt. 2te Abt. xi. 161.

THE AFFINITIES OF THE GUM.

From the reactions and the lævo-rotatory power both of the gum and the sugar resulting from its hydrolysis, the gum appears to be most nearly related to levulan and to inulin, but there are many characters which distinguish it from these. It is also different from the derivatives of inulin, viz., pyro-inulin, met-inulin and levulin, as well as from sinistrin, triticin, secalose, and myco-inulin.

From a review of the lævo-rotatory gummy substances that are hydrolysed to levulose, it appears that this bacterial gum has not hitherto been described. I therefore propose for it the name *levan*, which was suggested by the polariscopic nature of the gum and derived glucose, and also from the fact that another bacterial gum, which is derived from dextrose, and which yields dextrose on hydrolysis, is known as dextran.

THE PRODUCTION OF CARBON DIOXIDE.

During the evaporation of the cultures, a number of small bells formed upon the surface as if a gas were evolved during the process. The most probable gas is carbon dioxide, and to test for it a flask fitted with a rubber cork and lead-away tube was completely filled with a culture, inverted and heated in boiling water. The culture driven from the flask by its expansion, and by the liberation of the dissolved gases, passed through the tube in the cork and was led away into a vessel. The gases which collected in the flask were transferred to a tube and roughly measured before and after absorption with caustic soda. From 300 c.c. of culture fluid, 7·5 c.c. of gas were obtained, and of this 5 c.c. were absorbed by the alkali. It is evident that carbon dioxide is evolved during the growth of the organism. As, however, the test as described above was merely qualitative, and as the gas might be formed in quantity, a quantitative test was made. For this purpose 100 c.c. of culture fluid containing the usual amounts of saccharose and salts, but with 1 % of peptone, were placed in a small Erlenmeyer flask and connected with three other similar flasks, each containing 100 c.c. of clear baryta water. The inlet tube of the culture flask was fastened with a clip, and to the outlet tube of the third baryta flask a tube containing soda lime was attached to prevent the inward passage of atmospheric carbon dioxide. A current of air was sucked through the apparatus daily after attaching a soda lime tube to the inlet tube of the culture flask. The evolved gas was thus daily removed from the culture. On the fifth day the baryta solutions were added together and rapidly filtered, the barium carbonate was washed and then suspended in water. After adding phenolphthalein, 20 c.c. of standard acid were run in, and the solution boiled to expel the displaced carbon dioxide. The excess of acid was then determined, and by difference the carbon dioxide equivalent obtained.

11·6 c.c. $^{N}/_{2}$ acid used to decompose the barium carbonate
= 0·1276 grm. CO_2 from 10 grms. sugar
= 1·28 grms. CO_2 from 100 grms. sugar.

From the determination it is seen that a considerable quantity of carbon dioxide is formed during the fermentation.

The Production of Acid.

When the cultures were tested with litmus they were found to be distinctly acid, and when small cultures (10 c.c.) were titrated, quantities of $^{N}/_{5}$ alkali varying from 0·3 to 0·6 c.c. were required to neutralise the acidity to phenolphthalein. It was also noted that old cultures contained less acid than comparatively young ones, a circumstance which pointed to the volatilisation of a volatile acid. In connection with this it may be mentioned that the cultures, and also the air of the incubator containing the cultures, had a faint not unpleasant cheesy smell.

During the cultivation at 22° of a two-litre culture, 10 c.c. portions were abstracted and tested. By the second day the acidity was equal to 0·4 c.c. $^{N}/_{5}$ alkali, and it slowly rose to 0·45 c.c. on the tenth day. This is equivalent to from 0·07 to 0·08% lactic acid.

A number of 50 c.c. portions of saccharose media were infected with several races of the bacillus, and tested after incubation for

PRODUCTION OF ACID BY RACES GROWN FOR SEVEN DAYS AT 37°.

Source.	Race.	C.c. N/5 alkali required to neutralise 50 c.c.	Lactic acid %.
Roller cane juice... ...	O, 1st transfer	2·9	0·10
„ „ „	O, 21st transfer ...	1·95	0·07
Inverting sugar	I, 1st transfer	1·8	0·06
„ „	I, 23rd transfer ...	2·0	0·07
„ „	14, ...	3·7	0·13
„ „	23, ...	2·05	0·07
Acid sugar	30, 1st transfer ...	1·8	0·06
„ „	30, 21st transfer ...	1·75	0·06

It is evident from these results that the production of acid by the races is variable, and beyond the acidity being equal to between 0·06 and 0·13 % lactic acid, there is little to be inferred. Repeated cultivation of the races in the laboratory has no definite effect upon the acid-forming faculty, since in one case the cultivation has lessened the production, and in two others there is little difference. The amount of peptone in the nutrient fluid has a considerable influence upon the formation of acid, as was found in the experiments noted on page 596. With 0·01 % of peptone, the acidity on the fifth day was equal to 0·03 % lactic acid, while with 1 % of peptone the acidity was 0·18 %.

THE NATURE OF THE ACIDS.

In determining the nature of the acids a considerable number of cultures were made and tested. These were chiefly tentative or preliminary, and served to indicate the kinds of acids present and also the method which appeared to be best for their separation. Ultimately the following method was adopted :—

Two litres of the ordinary 10 % saccharose medium containing 100 grms. of chalk was infected with a mass culture (about 50 c.c.) of the organism and incubated at 37°. The culture was vigorously shaken every morning and the incubation was continued for a month, when it was noted that the evolution of gas bubbles had ceased. The culture was then treated in the manner described in the following table.

TREATMENT OF THE CHALK CULTURE.

<table>
<tr><td colspan="8">Two litres of culture incubated for 30 days with chalk; heated to 90°, filtered, washed.</td></tr>
<tr><td colspan="6">Filtrate evaporated to $\frac{1}{3}$ volume, allowed to crystallise overnight, strained and pressed.</td><td colspan="2">Residue, chiefly $CaCO_3$, decomposed with H_2SO_4; filtered, washed.</td></tr>
<tr><td colspan="2">Residue A.</td><td colspan="4">Liquor evaporated to $\frac{1}{3}$ volume, allowed to crystallise overnight, strained and pressed.</td><td>Residue B</td><td>Filtrate C, added to G.</td></tr>
<tr><td colspan="2">Residues A, D decomposed with H_2SO_4; after standing overnight filtered and washed.</td><td rowspan="3">Residue D</td><td colspan="3">Liquor acidified with H_2SO_4; after some time filtered and washed:</td><td colspan="2" rowspan="3">Residues B, E, F were dried on porous tile, powdered and saturated with ether. After several days the ether was sucked off, evaporated, and water added to separate insoluble acid which proved to be <i>Capric acid</i>.</td></tr>
<tr><td rowspan="2">Residue F</td><td rowspan="2">Filtrate G had C added and the whole was extracted with ether from which the acids were separated.</td><td rowspan="2">Residue E</td><td colspan="2">Filtrate distilled until $\frac{1}{2}$ passed over.</td></tr>
<tr><td>Distillate contained <i>Acetic</i> and <i>Formic acids</i>.</td><td>Residual liquor extracted with ether chiefly lactic acid.</td></tr>
</table>

Before proceeding to describe the separation of the acids from the ethereal extracts a few notes may be made upon the organic acids mentioned in the table. The distillate from the mother liquor had a strong odour of acetic acid and was neutralised with soda. To a portion of the neutral solution silver nitrate was added, whereupon a pasty, white precipitate was thrown down. This was filtered, washed and dried on a porous tile, then *in vacuo* over sulphuric acid and finally in the oven at 80° until there was a loss of only 0·5 mgrm. in 30 minutes. A portion was dissolved in water and the silver estimated as chloride in the usual manner.

0·3645 grm. gave 0·3115 grm. $AgCl = 64·33$ % Ag.

Silver acetate contains 64·68 % Ag.

It is evident from the analysis of the silver salt that the acid is acetic.

The filtrate from the silver acetate rapidly darkened, which made it appear probable that formic acid was also present. Accordingly the neutralised distillate was tested and was found to reduce alkaline permanganate to the brown hydrated binoxide and also to produce a copious precipitate of calomel when treated with excess of mercuric chloride. The latter test is characteristic of formic acid.

From the calcium sulphate residues a few droplets of an insoluble fatty acid were obtained. The melting point was determined by a method which I devised some ten years ago. Two small particles of the dry solid acid are placed near one another on a coverglass, another coverglass is put on the top and very lightly pressed. The space between the particles after the second coverglass is in place should be from one to two millimetres. The preparation is then floated on mercury and covered with a small watch glass. The bulb of a delicate thermometer is inserted in the mercury and the temperature slowly raised. At the melting point the two particles of melting fat run together, the space between them disappears, and almost instantly the molten fat spreads out between the coverglasses. The melting point of the separated fatty acid was 30·8° which is sufficiently near the melting point of capric acid (31·3°) to identify it with this acid.

The organic acids were extracted from the acid fluids by percolation with ether. The extraction was generally continued for 12 hours; sometimes with a large quantity of fluid the time occupied was 24 hours. After the extraction the ether was distilled off and the acids separated by a combination of the methods recommended by Schneider* and Harden.†

ANALYSIS OF THE ETHEREAL RESIDUE.

Ethereal residue diluted with water and distilled in a current of steam until the distillate had a constant acidity.

<table>
<tr><td colspan="3">Residual liquor divided into portions.
Portion digested with ZnO, filtered while hot and the zinc lactate proved by its solubility and also microscopically.
Portion digested with CaCO$_3$ on water bath for several hours, filtered.</td><td colspan="2">Distillate evaporated with excess of CaCO$_3$, treated with absolute alcohol, filtered.</td></tr>
<tr><td rowspan="2">Residue dissolved in acetic acid and tested for oxalic acid: none found.</td><td colspan="2">Filtrate evaporated to dryness, extracted with 90 % alcohol.</td><td rowspan="3">Residue extracted with water and solution tested for acetic and formic acids.
Acetic and formic acids found.</td><td rowspan="3">Filtrate.
Portion tested with Zn(NO$_3$)$_2$ for valeric acid; none found.
Remainder evaporated and residue tested for butyric acid.
Butyric acid found</td></tr>
<tr><td>No residue of succinate</td><td>Extract contained lactate.</td></tr>
<tr><td colspan="3">Portion of solution of calcium salt crystallised, dried and the calcium estimated.</td></tr>
</table>

Lactic acid was proved by the microscopical appearance of its barium, calcium and zinc salts, by its comparatively non-volatile character (with steam), its action upon alkaline permanganate, its behaviour on dry distillation, Windisch's reaction and the analysis of the calcium salt. In the analysis the residue remaining after distilling off the volatile acids was heated on the water bath for several hours with excess of calcium carbonate, filtered, evaporated, and allowed to crystallise overnight. A solid mass of crystals was obtained which, after drying *in vacuo* over sulphuric acid, was dried in the water oven till nearly of constant weight. In one portion the calcium was estimated, and in another the water (by drying in water oven till of constant weight).

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* Schneider, Journ. Chem. Soc. 1900, Abs. ii., 177.

† Harden, *ibid.* 1901, 614-5.

2·493 grms. contained 0·36 % of water and gave 1·1185 grms. $CaCO_3$ = 18·01 % Ca.

Calcium lactate contains 18·35 % Ca.

The butyric acid was separated as calcium butyrate by taking advantage of its comparative solubility in absolute alcohol. It was, however, never pure, being associated with formic and acetic acids. It was identified by the solubility of the calcium salt in absolute alcohol, by the pine-apple or rum odour of the ethyl ester, by the odour of the moist barium salt, and of the same salt when warmed with sulphuric acid. Finally the analysis of the silver compound prepared by the addition of silver nitrate to the mixture of substances obtained by dissolving the calcium salts in absolute alcohol while not absolutely agreeing with silver butyrate, is sufficiently distinctive (*i.e.*, low in silver) to show that butyric acid was contained therein. This silver compound, after precipitation and washing, was dried on a porous tile, and then at 80°, at which temperature there was no loss of water.

0·0548 grm. gave 0·0438 grm. Ag. Cl. = 60·16 % Ag.

Silver butyrate contains 55·38 % Ag.

Silver butyracetate contains 59·67 % Ag.

Silver acetate contains 64·68 % Ag.

With regard to the relative amounts of acids formed in saccharose solutions, a determination was made as follows. The acids separated from a fourteen days' chalk culture measured about 20 c.c. This was diluted with an equal volume of water, and distilled in a current of steam. When 141 c.c. had passed over the distillation was stopped, and a 10 c.c. portion was found to contain a quantiy of acid equivalent to 0·35 c.c. $^{N}/_{5}$ acid which for the whole 141 c.c. equals 4·9 c.c. The remaining 131 c.c. were evaporated down with chalk to dryness, and extracted with hot absolute alcohol. The calcium salt which dissolved weighed ·054 grm., and on the assumption that this consisted entirely of calcium butyrate, is equivalent to 0·048 grm. butyric acid in the whole distillate. The remaining acids (= 2·2 c.c. $^{N}/_{5}$), if taken as a mixture of equal parts of formic and acetic, would weigh 0·023 grm. This gives a total of 0·071 grm. of acids in the distillate. It must be borne in mind that lactic acid occurs in the distillate, and is calculated with the other acids, so that for this reason alone these figures must not be considered too narrowly. The main object in quoting them is to show how small is the quantity of the volatile acids when compared with the lactic acid. The residual fluid in the distilling flask was made up to 50 c.c., and 10 c.c. was boiled with zinc oxide and filtered. The filtrate, when evaporated and dried at 160°, yielded 1·076 grms. of a zinc salt. Another 10 c.c. was titrated with standard alkali by Kunz's method.* It contained—

Lactic acid	0·673 grm.
Dilactic acid as lactic acid ...	0·139 grm.
Total lactic acid	0·812 grm.

The zinc salts of these acids would have yielded 1·0745 grms., which agrees closely with 1·076 grms. found. In the total residual liquor there were, therefore, present 0·812 × 5 = 4·06 grms. lactic acid. Comparing this with the volatile acids, there is a ratio of 4·06 : 0·071 :: 57 : 1, and if some allowance is made for the lactic acid included in the volatile acids, it is evident that the bacillus forms about 60 times more lactic acid than volatile acids.

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* Kunz, Journ. Chem. Soc., 1901, Abs. ii., 428.

MANNITE IS NOT A BYPRODUCT IN THE GUM FERMENTATION.

In the mucinous fermentation of beet juice by some bacteria, as, for example, *Leuconostoc mesenterioides*, the sugar is fermented partly to dextran, or fermentation-gum, of which there are two kinds, one a soluble form, the other an insoluble modification, and partly to mannite. In order to see if mannite was a by-product in the fermentation of sugar by this bacillus, several culture solutions were freed from gum, and after evaporation to a syrupy consistency, were extracted with strong hot alcohol. No mannite crystals could be obtained from any of the cultures. The syrupy residue of one, however, after standing for a week, contained a number of feathery tufts of needle-shaped crystals which might have been mannite. The whole syrup was dissolved in water and the sugars fermented out with a pure culture of *Saccharomyces cerevisiæ* I. The yeasts were then filtered off with the aid of aluminium hydrate. Mr. Steel kindly tested the rotation of the solution before and after the addition of borax. A very slight lævorotation was observed; the mannite, if present, was apparently in so small an amount that it could not be definitely determined. He subsequently tested a solution obtained from a culture containing 46 grms. of saccharose, and could find no evidence of mannite. It is, therefore, apparent that the bacillus does not form mannite from sugar. The crystals observed in the syrup were probably dextrose. Mannite was carefully tested for, because a gum-producing organism, *Bac. gummosus*, Happ, forms this hexatomic alcohol in sugar solutions.

Ordinary alcohol is likewise not a product of the fermentation. A litre culture was distilled with chalk, and in the first 50 c.c. of distillate, which had a sp.g. of 1·0008, no iodoform reaction could be obtained.

THE VITALITY OF THE SPORES.

The spores of bacilli resist the action of moist heat at 100° C. for some time, and the gum bacillus is no exception to this rule. In testing how long they could withstand the action of boiling water, several tubes of saccharose media were infected with spores, and after attaching aerial condensers, the tubes were immersed in brine, which was kept slowly boiling. The media in the tubes boiled briskly. At intervals of ½, ¾, 1, 1½, 2½ and 5 hours, tubes were taken out, cooled, and thereafter incubated at 37°. In all cases growth occurred and gum was formed. The spores can, therefore, withstand the action of boiling water for at least five hours.

According to Lafar, the potato bacillus can resist the influence of a current of steam for six hours, which marks it as being the most powerfully resistant of all organisms hitherto observed. The spores of the gum bacillus resist destruction as vigorously as the potato bacilli, and, as we shall see, this is not to be wondered at, for they have many points in common.

THE VARIETIES OF THE ORGANISM.

So far, with one exception, the action of a bacillus which was separated from roller cane juice has been considered. In the examination, however, of a number of raw and refined sugars, many races of the same organism were isolated. A few of these grew slowly, but otherwise they were identical with bacteria of quicker growth. From the more or less extended examination of some sixty bacteria, it became manifest that the races fell into one, two, or three groups, according to the value placed upon their growth characteristics. If they are divided into three groups, the third of these (ββ of table) must be considered as being derived from the second (β), since upon repeated cultivation the characters alter and become identical with those of β group. The β group differs from the α group chiefly in its method of growth in gelatine.

GENERAL CHARACTERS OF THE GROUPS

—	α	β	ββ
Agar stroke ...	Translucent white, amœboid layer, irregularly furrowed, dry or slightly moist, adhering firmly to the medium: often with glistening convex margin: the condensed water has a strong film.	White, amœboid, and sometimes terraced layer, dry and generally dull, adhering loosely to the medium, often with glistening, convex margin: condensed water with strong film.	Broad, glistening, yellow to buff, raised lobular growth: condensed water has no film.
Gelatine stab ...	Medium is liquefied very slowly as a small crateriform depression with white wrinkled film: stab at first filiform, then becomes arborescent (4-5 days).	Medium is liquefied quickly as a crateriform area. Then becoming saccate in 2-3 days, forms a loose surface film.	As β.
Potato	Reddish-white, dry, finely wrinkled growth on reddish ground: often with raised, apparently exuded, drops of watery fluid.	Pale yellow, deep yellow or yellow-brown raised undulating fatty growth, becoming dry and coarsely wrinkled.	As β.
Bouillon ...	Turbid, with strong wrinkled film.	As α	Turbid, but no film.
Milk	Curdled, then partly peptonised with faint acid reaction.	As α, but with alkaline reaction.	As α, with amphoteric or alkaline reaction.
Shape	Thin rods, 0·4-0·6μ broad.	As α	Thick vacuolated rods over 1 μ broad.

The differences between ββ and β are very striking, and it would almost seem impossible that they could both be of the same kind. Fortunately the alteration or reversion to the normal type occurred in the course of a few crops or transfers (erroneously called generations) with one of the races which was considered as being typical of group ββ, and the identity of the groups was made evident. While with this race the change occurred by the 8th transfer, two other similar ββ races had not changed by the 40th transfer. From a glistening lobular yellow raised stroke, it altered to a dull white amœboid expansion spreading over the greater portion of the agar surface. Concomitant with this alteration, the granular or spongy structure of the bacterial protoplasm changed, and when stained the rods appeared narrow and homogeneous. The nature of the growth in bouillon, and on potato, also changed. In short, the race had become identical with those of group β. The reversion is shown in a somewhat diagrammatic form in the plate which accompanies this paper.

Why ββ should be so different from β can only be explained by assuming that it has been caused by the physical conditions that have obtained during the process of manufacture of the sugar. In the various samples of sugar the three groups of bacteria were generally found in varying proportions. This might point to the sugar having been infected at different periods of the manufacturing process, for if it were otherwise, only one group of bacteria would be found in each lot of sugar. As a rule, however, the prevailing bacteria were of the β kind.

The cultural variation of the race does not have
upon the production of gum. With one race
which maintained its character through
of gum formed in 12 days at 37° w
100 grms. saccharose originally t
identical with that already desc

BACILLUS L

Shape, &c.—The films p
show the organism as a
occur singly and in ch

siderably, but, generally speaking, those races which produce white growths on nutrient agar (α and β) consist of cells measuring 0·4-0·6 : 2-3 μ. Occasionally a race of this normal type will have broader rods mixed with cells of that breadth. Those races which produce a buff colour on nutrient agar ($\beta\beta$) consist of a mixture of short, stout and of long rods varying from 1·3 : 2 to 1·0 : 6 μ. All cells stain readily, and are not decolorised by the Gram method. The broader cells appear to have a spongy structure, while the narrower cells stain uniformly. The rod forms a small oval and generally central endospore, readily with the white, but slowly with the buff races. Indeed, with the white races, the film on a 24 hours' bouillon culture at 37° consists chiefly of spores. Germination is lateral. The rods are motile, and in bouillon move about with a wriggling motion. In films of fluid saccharose media, the newly germinated rods have an active, darting motion. When films are prepared from a young agar culture, and stained by the night-blue mordant, as advised by Morton (Trans. Jenner Inst. ii.), the majority of the cells are seen to be capsulated, and [illegible] many peritrichous flagella. Sketches of a few typical [illegible] with the camera lucida accompany this paper. T [illegible] ures of the organism in fluid and sometimes in [illegible] quently show coccoid and streptococcoid swollen [illegible] however, have ceased to form [illegible] cond, th [illegible] ansfer.

[illegible] *Oxyge* [illegible] ractically [illegible] wth under a [illegible] tion [illegible] tubes, [illegible] on agar is [illegible] and [illegible] becon [illegible] urbid. In [illegible] occurs [illegible] limb.

[illegible] The [illegible] ar white, or [illegible] and [illegible] nd fatty. In [illegible] onies [illegible] id and form a [illegible] gin, [illegible] f the colony may [illegible] y gl [illegible] races the amœboid [illegible] e deep colonies are [illegible] us, [illegible] lonies are marbled or [illegible] margin. The amœboid processes are clouded and finely granular, with a clear central canal. Group $\beta\beta$: the colonies vary from dirty white to buff-white, and have a fatty or dull appearance. When magnified, the deep colonies are seen as irregular clumps; the surface colonies appear dark grey and marbled, with either a stippled or a filamentous margin, and a smooth or a rough edge.

Saccharose(10 %)-*peptone*($\frac{1}{10}$ %)-*agar plate.* — The colonies of the a and β types appear like raised drops of whey upon an amœboid base. When magnified, the deep colonies are lenticular and clouded; the surface colonies being clouded and hatched. The amœboid processes of the surface colonies have a hatched centre, a finely granular intermediate portion, and a clear margin. The colonies of the $\beta\beta$ type are circular and yellowish, or dirty white. The agar below the surface may swell into a dome-shaped prominence bearing the colony. Subsurface colonies cause the agar to swell locally and split.

Agar stroke.—Group a: The races form a translucent white amœboid growth spreading over the greater portion of the agar surface. The growth becomes irregularly furrowed or indented, and appears either dry or slightly moist. Sometimes the surface is covered with minute drops of fluid, which gives the culture a shagreen appearance. The upper margin of the stroke is frequently raised and glistening. The central portions adhere so firmly to the agar that it is impossible to remove portions with the ordinary thin platinum needle. The condensed water is covered with a strong, white, wrinkled film. Group β: The cultures are whiter than the a races, and show a greater diversity of appearance. The growths are amœboid, and either flat or terraced. They may be dry or glistening. A white central portion may have a narrow or broad raised translucent margin. Some races differ from those of the a group only in having a fatty consistence, so that portions of the culture can be easily removed with the needle. Like the a group, the cultures form a strong, white, wrinkled film on the condensed water. Group $\beta\beta$: The growth is broad, raised, luxuriant, and varies in colour from primrose through stone to buff. It is lobular and spreading, but never amœboid. It appears either moist, glistening, or fatty, and the consistency is soft like that of butter. The condensed water generally has a flocculent yellowish sediment, but never has a film.

Saccharose-peptone-agar stroke.—With all groups, there is formed a broad convex ridge, undulating as if containing gelatinous lumps. The growth is translucent and indistinguishable from the medium. The consistency is gelatinous.

Gelatine plate.—Group *a*: The colonies grow slowly; on the third day they are white and punctiform. When magnified, the deep colonies are seen to be round, moruloid or like woolly tufts, with outstretching fibres interspersed with cellular clavate processes. The surface colonies are rounded erose, with a granular centre and clouded margin. On the fourth day the surface colonies appear depressed and are seen, microscopically, to be deeply pitted and wrinkled, and to have a rough margin. On the sixth day the surface colonies consist of a dry, wrinkled film, with a central white point. There is a slight softening of the gelatine, and in crowded plates the medium becomes slimy. Groups β and ββ: White circular crateriform liquefied areas containing a white sediment are formed in two days. Microscopically the sediment consists of coarse granules, and the margin of the colony (liquefied area) is ciliate. The deep colonies appear circular and either opaque or coarsely granular, with a ciliate edge.

Gelatine stab.—The stab is primarily filiform, with a slight depressed surface growth. In from four to six days, the needle track is beset with coarse white arborescent outgrowths, and the gelatine at the surface is slightly liquefied and consumed. The liquefied medium is covered with a deeply wrinkled film. Groups β and ββ: The growth is at first white and filiform, but the medium is sooner or later (1-2 days) liquefied, the top of the stab becoming funicular; finally the entire stab becomes saccate. There is formed a thin surface-film.

Bouillon.—Groups *a* and β: The medium becomes faintly turbid and covered with a strong but easily detachable wrinkled white film. Group $\beta\beta$: The bouillon becomes turbid and forms a white sediment and a very slight surface-ring. Indol is formed by all the groups, and nitrate may be slightly reduced to nitrite.

Milk.—All groups coagulate and then slowly peptonise the casein, but group a is much slower in its action. The reaction of the supernatant liquid may be faintly acid (a), amphoteric ($\beta\beta$), or alkaline (β).

Peptone-saccharose fluid.—The white, milk-like appearance is very characteristic.

Potato.—Group a: There is formed a reddish-white thin layer upon a reddish ground. The thin layer becomes folded into small delicate wrinkles. Sometimes in place of wrinkles drops of a white watery fluid exude from spots scattered over the apparently red surface of the potato. Group β: The cultures are of various shades of stone, yellow or yellowish-brown. They are raised and undulating and soon (3-4 days) become coarsely wrinkled. Group $\beta\beta$: The growths are similar to β, but in addition the medium is frequently darkened in the vicinity of the culture.

Temperature.—The organism grows at 15°, 22°, 30°, and most quickly at 37°; above 37° the growth rapidly diminishes; with the exception of the cultures in gelatine, which were made at 22°, the descriptions of the growth characters apply to cultures at 37°.

THE GUM-FORMING BACILLI PREVIOUSLY DESCRIBED.

From the literature at my disposal upon this subject I have found notes upon a number of sporeless bacteria capable of converting saccharose into gummy substances when natural media, such as slices of beet, were infected. As, however, the organism separated by me is a spore-forming bacillus, mention of other spore-bearing organisms which are known to form gum from saccharose need only be made.

Fritz Glaser* separated an actively motile short rod-shaped bacterium, *Bact. gelatinosum betæ*, from beet juice that had undergone a mucinous fermentation. It rapidly liquefies gelatine, produces gas when grown in beet juice at 40-45° C., and is not killed when heated to 100° C. This fact would indicate the presence of spores, but the author apparently never observed spore formation. The organism also inverts saccharose, forming a quantity of alcohol but no lactic acid. According to Lafar* the alcohol is amyl alcohol. From but a few tests, Glaser considered the gum to be probably identical with Scheibler's dextran or beet gum.

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* [illegible]

Ritsert† separated from a slimy digitalis infusion an organism, *Bact. gummosum*, which formed gum in saccharose solutions containing nutrient salts such as potassium acetate and ammonium phosphate. Similar solutions of grape sugar or of milk sugar did not produce gum after infection. In the saccharose cultures nearly half of the sugar was converted into gum, which was estimated by precipitation with alcohol and weighing. Besides the gum, which he named gummose, an acid and a dextro-rotatory body capable of reducing Fehling's solution were formed. The organism was an anthrax-like rod which formed threads, chains of rods, streptococcus, diplococcus or coccoid forms according to the medium in which it was growing. It formed endogenous oval spores and the rods were not stained when treated by the Gram method. The growth on agar was lobular and glistening white; after a few days it showed two zones—the inner wrinkled, raised, dry and white; the outer glistening and bluish-white. In bouillon the rod was feebly motile. Alkaline gelatine was liquefied.

Happ‡ also separated from digitalis infusion a bacillus, *Bac. gummosus*, capable of producing a gummy fermentation in vegetable infusions. It appeared as a large thick rod with rounded corners, measuring 0·6-2 : 5-7·5 μ. It was weakly motile; flagella and spores were observed. The colonies on gelatine were at first circular, then processes were sent out into the medium which quickly liquefied. In stab culture the liquefaction of the gelatine was funicular. On agar, the stroke became a moist glistening and characteristically lobular (? amœboid) growth. On coid involution forms were noted on the second day. nedium the growth is at first moist glistening, but after ks it became a whitish folded skin adhering firmly to um. The optimum temperature lay between 25° and 30°. presence of saccharose is absolutely necessary for the formaof gum; no other sugars induce the mucoid fermentation. ne substances are favourable to the fermentation, but these absolutely essential, since in their absence sugar solutions can n gum. Albuminoids are wise not absolutely necessary in the fermentation. The b oducts are mannite, lactic acid, butyric acid and carbonic Only a small part of the saccharose is converted to dextro

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* Lafar, Technical Mycology.

† Ritsert, Cent. f. Bakt. 1te Abt., xi. 730, Ref.

‡ Happ, Cent. f. Bakt., 1te Abt., xiv., 175, Ref.

THE AFFINITIES OF E BACILLUS.

Fritz Glaser has not described l bacterium at all fully, and he did not investigate his gum with y detail, but from the fact that it forms (amyl?) alcohol and lactic acid it is evidently different from that which I have investigated.

Both Ritsert's and Happ's orga sms are like one another. They were separated from the same ind of infusion, they show a similar variability of form according to the medium; they produce acids and they invert saccharose. With regard to the inversion, Ritsert has not described the product of inversion otherwise than as a dextro-rotatory body capable of reducing Fehling's solution, while Happ said that only a small part of the saccharose was inverted. The byproducts in the fermentation of Happ's bacillus are mannite, lactic acid, butyric acid and carbonic acid. Ritsert did not identify his acid, and does not mention mannite. I can find no mention of the nature of Happ's gum beyond its being soluble in water, insoluble in alcohol and ether, and having the composition $(C_6H_{10}O_5)_n$. Ritsert's was optically inactive.

Although one cannot identify these two organisms by their enzymic activities, it is possible from their cultural characters that they are varieties of one common type, and that is possibly *Bac. vulgatus*, to which my organism is probably also related.

There are, however, many points of difference between the chemical products of my bacillus and those of Ritsert and Happ. Since it is the products which mark the importance of the organism, and since these are different to the products of bacteria already described, I have thought it advisable to give the organism the distinctive name of *Bacillus levaniformans*. At the same time it must be borne in mind that it is probably a variety of *Bac. vulgatus* which, together with several other allies, constitute the potato group of bacteria. The members of this group of bacteria have many points in common; in fact there are so many common characters that what are at present called species are undoubtedly only races. To show this I shall enumerate shortly the characters of these species as described by Lehmann and Neumann, and it will be seen that *Bac. levaniformans* has affinities with all the members of the group.

THE MESENTERICUS GROUP OF BACILLI.

Bacillus (mesentericus) vulgatus occurs as a thin rod, with slightly rounded ends, measuring 0·8 : 1·6-5 μ. It frequently forms threads, and easily produces plump oval spores. The rods are motile and are studded with flagella. The bacilli are stained by Gram's method. On gelatine plates there are formed crateriform liquefied areas covered with a delicate whitish folded film. In gelatine stab culture there is a crateriform liquefaction over a filiform growth. On agar plate, there appear whitish, moist glistening, raised, smooth or rough-edged colonies. When magnified the centre of the colony appears homogeneous without markings, and the margin is often filamentous; the deep colonies are homogeneous and frequently ciliate. The agar stroke is raised, lobular, fatty and grey-white; after some time it becomes folded and the condensed water is covered with a strong film. Bouillon is made turbid and forms a strong grey-white film; no indol is formed. Milk is curdled and has a slimy consistency; the reaction is strongly alkaline. The potato cultures are most variable. The typical growth is raised and irregularly swollen like the mesentery, whence its general name, *Bac. mesentericus* *vulgatus*. The colour is partly whitish-grey, partly yellowish or yellow or even reddish-brown. The culture finally covers the potato as a slimy mass.

Bacillus mesentericus (fuscus) differs from *vulgatus* chiefly in colour and in not liquefying gelatine so quickly. The liquefied gelatine in stab culture has a surface film. The stroke on agar is yellow-brown. On potato the growth is raised, moist glistening, greyish-yellow and slimy, afterwards becoming a dull raised network. Traces of indol are formed in bouillon.

Bacillus liodermos differs from *vulgatus* in forming on potato a smooth glistening yellowish-white syrupy growth which is soluble in water and precipitated from solution by alcohol.

Bacillus mesentericus ruber is very similar to *vulgatus*. It forms colonies of various shape on gelatine which is slowly liquefied. The agar-stroke is translucent, grey-white, moist glistening, and eventually becomes like a network. The growth on potato is mesentery-like and of a rose-red colour which ultimately becomes reddish-brown.

It is quite probable that the four members of the potato group are all varieties of one typical bacterium, which we may assume to be that most commonly occurring, viz., *vulgatus*. The others differ but slightly from it. Examples of a similar variation are not wanting among the bacteria. Among the yeasts the varieties of *Sacch. cerevisiae* appear to be limited only by the number of breweries. Conn noted the occurrence in nature of a white coccus, varieties of which did or did not liquefy gelatine. Schierbeck* separated from one sample of milk races of lactic bacteria which differed in their fermentative power, and moreover the difference was apparently fixed so far as the race was concerned.

But coming to the *vulgatus* group itself, there are instances where one or other of the members have developed the power of causing bread to become slimy. Uffelmann† ascribed the exciting cause of slimy rye-bread to *Bac. vulgatus*, after separating from the bread that organism and *Bac. liodermos*. Juckenack* separated *Bac. mesentericus* in pure culture from a batch of ropy rye-bread. Eccles† found the slimy fermentation quite commonly in the bread of certain localities when it had been kept warm for some time after baking. He traced the fermentation to *Bac. vulgatus* and *Bac. liodermos*, the latter producing a greater degree of sliminess than the former. We thus have cases of a particular kind of fermentation—the alteration of the crumb of bread into a gummy or ropy mass—induced by *vulgatus*, *mesentericus* and *liodermos*. This assumption of a common function by these so-called species when considered with the fact that their cultural characters are not very distinctive is enough to indicate the probability of the species being really races of one bacillus.

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* Schierbeck, Cent. f. Bakt. 1te Abt., vii, 239, Ref.

† Uffelmann, Cent. f. Bakt. 1te Abt., viii., 481.

Ritsert's *Bac. gummosus* and Happ's *Bact. gummosum* do not apparently differ greatly from *Bac. vulgatus*, and may well be races. Lehmann and Neumann consider that they are allied to that bacillus.

With regard to the races which were separated in this research, they appear to be allied not to any particular member but to the group as a whole. The race which was separated from cane juice and which I have called the *a* type, appears, if the growth on potato is an index, to be related to *Bac. mesentericus ruber* as well as to *Bac. vulgatus*. The arborescent growth in gelatine stab culture is peculiar to that race, and does not occur among races which are identical in every other respect. The races of the derived type are closely related to *Bac. mesentericus* so long as the cell protoplasm remains granular or spongy. Once the protoplasm condenses, as it may do by repeated cultivation in artificial media, the colour, the appearance aud the consistence of the growth upon agar also change, and the race becomes related to *Bac. vulgatus*, but still differs from it by reason of the spreading, amœboid nature of the agar culture. The races when grown on agar show practically every variation from a slight, almost transparent, watery smear to the luxuriant, corrugated, amœboid, tough layer over most of the agar surface.

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* Juckenack, *ibid.* 2 te Abt., vii., 109, Ref.

† Eccles, Jour. App. Microscopy, iv. (3), 1222, Abs,

THE SOURCE OF THE BACILLUS.

It must not be presumed that the organism is derived from the gum of "gummy cane," *i.e.*, plants affected with gummosis. It can be affirmed without a shadow of doubt that it does not, for the reason that the gum which is found in gummed canes is absolutely different from the gum formed by the bacillus. At one time I thought it just possible that a different medium might produce a different gum, and grew the bacillus in plant infusions (*e.g.*, hay, turnip) with sugar, but the gum produced in such infusions was found to be identical with that formed in the peptone solution. We can, therefore, say that the bacillus produces only one kind of gum, viz., levan, which is absolutely different from cane gum.

The microbe has been separated from cane juice and from refined sugars, and since it occurs in these two places—the beginning and the end of the manufacturing process—it will certainly be found in all positions in the factory and the refinery. It undoubtedly obtains access to the factory with the cane,* most probably on the outer surface of the plant. And having once got into the manufactory, and being in congenial surroundings, it will thrive luxuriantly unless means are adopted to check its growth. Experience has taught the manufacturer that the best preventative for gumming is to push on the crystallisation of the sugar as quickly and at as high a temperature as possible.

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* The bacillus was obtained from the interior of a portion of gummy cane from Fiji, but as the portion had been lying about the benches in the laboratory of the Colonial Sugar Refining Co. before it came into my possession, there is the possibility that the organism obtained access to the centre of the cane during that time. I sought for the bacillus in five samples of gummy cane from New South Wales, and found it in the tissues of one of the samples.

To this may be added the hackneyed suggestion of disinfecting the premises and plant whenever possible.

If the manufacturer desired to produce gum, he would use such a saccharine fluid as cane juice, and after clarification infect it with the bacillus. Then he would keep the juice as near 37° C. as possible, but not much over that temperature, and certainly not over 44° C. The juice would also be well aerated by tossing or spraying, and finally the fermentation would be allowed to go on until the maximum amount of gum had been formed. Repeated infection during the process, as by running the juice into dirty vessels, &c., would greatly assist the production. With this knowledge of how to best produce gum, it is easy to see how the formation can best be prevented.

To the intelligent manufacturer the knowledge of the cause is enough to give the cue for its attempted elimination. Whether this is possible, experience alone can show. Were it not for the constant infection from without by the introduction of infected material, the trouble might be overcome. Probably all the manufacturer can hope for is a diminution of the gumming. The microbe is exceedingly hard to kill. The vegetating forms must be, to a certain extent, protected, during a part of their life at least, by the gum capsules, and the spores can resist the action of boiling water for at least five hours. But difficult as the task is, it must be attempted so that the manifold changes which the microbe induces may be minimised or prevented.

EXPLANATION OF PLATE.

The figures illustrate diagrammatically stages in the conversion of the derived type of *Bacillus levaniformans* (right figures) to the normal type (left figures). The medium, the number of the transfer or crop, and all colours except white are noted. Shading indicates a dull appearance, absence of shading shows that the culture had a glistening appearance when examined. The two types were inoculated, incubated, and observed side by side. One-half natural size.

THE CHEMICAL PROPERTIES OF BACTERIAL GUM LEVAN.

By Thos. Steel, F.L.S., F.C.S.

The production of gum levan by the action on sucrose of a new bacillus, *B. levaniformans*, isolated from samples of cane juice and of sugar which had been found to be undergoing inversion, is described by Mr. R. Greig-Smith, M.Sc., in the preceding paper. My examination into some of the properties of the gum was made on material given to me by Mr. Smith, for an abundant supply of which I am indebted to him.

The gum was purified from sugars by precipitation with alcohol from solution in water. After drying at 100° C. it contained 0·125 per cent. of nitrogen, equivalent to 1·0 per cent. proteid. The ash amounted to 1·4 per cent.

Deducting these constituents, which may be regarded as impurities, the preparation contained 97·6 per cent. of gum. It is on this figure that the products of inversion, &c., are calculated below.

The solution of the gum in water is opalescent, less so, however, when concentrated than when moderately dilute.

When a hot, strong solution is allowed to stand in the cold, it forms a mucilage resembling that produced by gum arabic, and does not become at all gelatinous.

The gum is insoluble in spirit, by which it is precipitated from aqueous solution.

It is not precipitated by subacetate of lead, nor by ammoniacal silver nitrate, but forms a white precipitate with ammoniacal lead acetate.

Owing to the persistent opalescence of the solution, which is not removed by any ordinary means of treatment such as filtration with hydrate of alumina, &c., it is not possible to determine the specific rotatory power of the gum except in dilute solution. A solution containing 1 gram. of the crude gum in 100 c.c. water observed in a 100 mm. tube in a Polarimètre-Laurent with monochromatic soda flame, gave a reading of $-0{\cdot}39°$ at 20° C., which is equivalent to a specific rotatory power of about $[a]_D^{20°} - 40°$ for the pure gum.

After oxidation at 60° C. with nitric acid of 1·24 sp. gr., oxalic acid was obtained, but neither mucic nor saccharic acids. The yield of oxalic acid varied in different trials between 12·8 and 16·8 $C_2 H_2 O_4$ per cent. on the pure gum, the solution also containing much reducing sugar. On treatment with dilute hydrochloric or sulphuric acid at 60 to 70° C., the gum is readily hydrolysed, the sole product being levulose, which is produced in practically the theoretical quantity required by the formula:—

$$C_6 H_{10} O_5 + H_2O = C_6 H_{12} O_6$$

In some respects this substance resembles Lippmann's levulan (Ber. 14, 1509), a body found in the juice of beetroots and in the residual molasses produced during the manufacture of sugar therefrom. The most important points of resemblance are in yielding levulose on hydrolysis, and in possessing a lævorotatory power.

From levulan it differs (*a*) in having a much lower rotatory power, that for levulan being, according to Lippmann, $[a]_D - 221°$, while the present substance is only about $[a]_D - 40°$; (*b*) in giving no blue precipitate with Fehling's copper solution; and (*c*) in the concentrated hot solution not gelatinising on cooling.

In his original description of levulan (*loc. cit.*), Lippmann stated that it yielded mucic acid on oxidation with nitric acid, and this statement has been copied into works of reference) Thorpe, Dictionary of Applied Chemistry, ii., 280, 1891; Watts's Dictionary of Chemistry, iii., 116, 1892; Allen's Commercial Organic Analysis, i., 423, 1898). Subsequently Lippmann (Ber. 25, 3216,

1892) corrected the above statement, he having found it to be erroneous.

The facts of the $[a]_D$ being $-40°$, and the gum yielding only levulose on hydrolysis at once suggested inulin, and I therefore made a careful comparison of its behaviour with sundry reagents, as against that of inulin, and, for purposes of comparison, the closely allied body starch.

The results of this comparative examination are stated in tabular form below.

——	GUM LEVAN.	INULIN.	STARCH.
$[a]_D$	Lævo.	Lævo.	Dextro.
Oxidation nitric acid ...	Oxalic acid. No mucic acid.	Oxalic acid. No mucic acid.	Oxalic acid. No mucic acid.
Cold water	Very soluble.	Sparingly soluble	Insoluble.
Hot water solution after cooling	Mucilaginous.	Limpid.	Gelatinous.
Heated for some time at 100°C. with water	Unchanged.	Hydrolysed to levulose.	Unchanged.
Hydrolysis with acid ...	Levulose.	Levulose.	Dextrose, &c.
Baryta water	Ppt.	Ppt.	Ppt.
Lime water	No ppt.	No ppt.	Ppt.
Cream of lime	Pptd.	Not pptd.	Pptd.
Strontia water	Ppt.	[*]	Ppt.
Lead subacetate	No ppt.	No ppt.	Ppt.
Ammonia lead acetate ...	Ppt.	Ppt.	Ppt.
Action of solution in cold on litharge	Does not dissolve litharge.	Dissolves litharge.	Does not dissolve litharge.
Ammonia silver nitrate in dark	No reduction.	Reduced.	No reduction.
Boiling Fehling copper solution	No reduction.	Slowly reduced.	No reduction.
Iodine	No action.	No action.	Blue compound.
Cuprammonium	Dissolves, does not deposit on standing.	Dissolves, throws down heavy ppt. on standing.	Does not perfectly dissolve. Throws down moderate blue sediment.

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[*] Several examples of carefully purified inulin which I prepared from dahlia tubers grown at Sydney, gave a copious precipitate when a solution was mixed with strontia water, but a sample procured from Europe, the source of which I do not know, gave no reaction when treated in the same way, though all the other tests gave results identical with the Sydney preparations.

From a consideration of the foregoing it will be seen that gum levan differs from inulin in its properties about as much as the latter does from starch. The most striking points of resemblance between levan and inulin are the $[a]_D$ and the production, on hydrolysis, of levulose only.

The figures following show the effect of the growth of the bacillus in a solution of sucrose of 10 per cent. strength.

After removal of the gum by precipitation with alcohol, and concentration of the saccharine solution, the residual syrup obtained was found to contain for each 100 parts of sucrose originally present:—

Sucrose	5·4
Dextrose	41·4
Levulose...	20·6

It is thus seen that during its growth the bacillus has inverted the sucrose, and then assimilated levulose. As sucrose, on inversion, yields equal proportions of dextrose and levulose, the difference between these two sugars in the residual syrup represents the levulose which has been used by the bacillus, and amounts to 20·8 per 100 original sucrose. If there were as much levulose present as dextrose, the sum of the two would be 82·8, which is equivalent to 78·7 of sucrose. This proportion, with the 5·4 still present, leaves 15·9 of sucrose not accounted for. A little of this will be due to mechanical losses during manipulation, and the remainder, which may be stated as at least 10 per cent., represents sucrose used up by the bacillus in addition to the missing 20·8 of levulose. These results were checked by the examination of several different cultures, and in each case results of a similar nature were obtained.

In a culture made in 20 per cent. solution of sucrose, the growth of the bacillus was not nearly so abundant as in those made in 10 per cent. solutions, and the transformation of sucrose correspondingly less complete.

In the disease known as "gumming" in sugar cane, on cutting the stalks across the fibro-vascular bundles are found to be packed with a viscid gum. This substance is quite distinct from gum levan, and has properties differing considerably.

The above investigation was carried out in the laboratory of the Colonial Sugar Refining Company, Limited, Sydney, and I am enabled to make use of the results by kind permission of Mr. E. W. Knox, general manager, and Mr. T. U. Walton, B.Sc., F.I.C., &c., principal chemist.

NOTES AND EXHIBITS.

Mr. D. G. Stead exhibited two deformed Malekulan skulls from the southern end of the island, one of them with a persistent occipital suture; sections of wood showing the junction of host (*Casuarina* or *Eucalyptus*) and Mistletoe (*Loranthus*); a strikingly marked Crab, *Carpilius maculatus*, from Tanna, New Hebrides; specimens of two species of Orthoptera common about Sydney; the Megalops-stage of a Crab; and examples of the beautiful macrurous Crustacean *Rhynchocinetes typus*.

Mr. Hedley exhibited a specimen of the shell usually known as *Ranella leucostoma*, Lamarck; and he explained that this well known name must be abandoned under the following circumstances. It was published in August, 1822, by Lamarck in the "Animaux sans Vertèbres" (1st Ed., vii. pt. 1, p. 150). In the second edition of this work (Vol. ix., p. 542), Deshayes cites an illustration of this species by Perry. On consulting Perry's work, "Conchology, or the Natural History of Shells" (1811), we find *Ranella leucostoma* unmistakably figured on Pl. 14, fig. 2, and described as from New Holland and Van Dieman's Land, under the name of *Biplex australasia*. Perry's genus *Biplex* must, however, yield to that of *Gyrineum* of Link (1807). Hence *Gyrineum australasia*, Perry, should be the name adopted for the local species. On behalf of Mr. R. L. Cherry he exhibited also specimens of *Conus capitaneus*, L., collected on a beach immediately north of the entrance to Lake Macquarie, and *Vexilla vexillum*, L., found three miles south of Lake Macquarie Heads. Mr. Cherry is the first to bring to notice either of these tropical forms in New South Wales.

Mr. Froggatt exhibited very fine samples of lac recently collected by him near Bundaberg, Q. The lac is formed abundantly on *Melaleuca leucadendron* by an undetermined species of *Tachardia*, specimens of which were also shown.

Mr. R. T. Baker exhibited, on behalf of Mr. Hugh Dixson, specimens of Vanilla (*Vanilla planifolia*, And.) grown by that gentleman at his private residence at Summer Hill, near Sydney. The pods appeared to have been quite successfully cured, as they possess all the characteristics of the commercial article, and the aroma and shining surface in no way seemed to differ from those of the true Mexican Vanilla. One vine yielded about 50 pods.

Mr. R. Greig Smith showed cultures in various media of the Bacillus described in his paper; also samples of the gum, levan.

Mr. North communicated the following Note. The bird named *Motacilla cyanea*, by Ellis, was met with during the stay of Captain Cook's vessels, the "Resolution" and "Discovery," in January, 1777, at Adventure Bay, Bruni Island, near the south-east coast of Tasmania. At that time Bass Strait had not been discovered, and the latter island was regarded as the southern extremity of Australia, and is so figured by Ellis, who was assistant-surgeon to both vessels, on the chart accompanying his work, published in 1782. The name of *Malurus cyaneus*, Ellis, will, therefore, have to stand for the Tasmanian species of Superb Warbler, and that of *Malurus superbus*, Shaw, for the well known species inhabiting south eastern Australia. Mr. North also pointed out that several species of Cuckoos were unusually numerous this season in the neighbourhood of Sydney. During the present month he had found four nests of the Rock Warbler, *Origma rubricata*, three of which each contained an egg, and the fourth a young Fan-tailed Cuckoo, *Cacomantis flabelliformis*, Lath. He also found an egg of this Cuckoo in the nest of Lambert's Superb Warbler, *Malurus lamberti*, Vig. and Horsf., and from another nest of the latter species obtained an egg of the Rufous-tailed Bronze Cuckoo, *Lamprococcyx basalis*, Horsf. Previously the eggs of both these species of Cuckoo had not been recorded from the nests of Lambert's Superb Warbler.

The President showed some drawings and actual specimens of types of Eucalypts referred to in his paper.

Rev. Walter W. Watts communicated the following

Notes on Some New South Wales Hepatics.

Having received a second list of determinations from Dr. Stephani, through the kindness of Dr. E. Levier, I desire to place on record the following *Hepatics*, most of which were collected on the Richmond River. How many of them are new to New South Wales I am unable to say.

* *Acrobolbus unguiculatus*, (Hook. f. et Tayl.) Mitt.
* *Acrolejeunea securifolia*, (Nees) Steph.
* *Aneura multifida*, Duni.
* *Anthoceros Brotheri*, Steph.
„ *communis*, Steph.; Blue Mts. and Mosman's Bay.
* *Dendroceros Muelleri*, Steph.
* *Frullania diplota*, Tayl.
* „ *Hampeana*, Nees.
* „ *pentapleura*, Tayl.
* „ *spinifera*, Mitt.
* „ *squarrosula*, Mitt.
Jamesoniella colorata, (Nees) Spruce; Blue Mts.
„ *Sonderi* (Gottsche) Spr.; Blue Mts. and Newcastle.
* *Lejeunea* (*Eulejeunea*) *flava*, Swz.
* „ „ *Nietneri*, Steph. ("with doubt").
„ „ *subelobata*, Pearson; Mosman's Falls, near Sydney.
* „ „ *tumida*, Mitt.
* *Lepidozia Gottscheana*, Lindenb.; also Blue Mts.
* „ *reversa*, Pearson.
* „ *sexfida*, Steph.
Lophocolea Bridelii, Nees; Emu Plains and Newcastle.
* „ *heterophylloides*, Nees.
* *Madotheca Stangeri*, Gottsche.

Those marked with an asterisk are Richmond River species.

* *Mastigobryum elegans*, Colenso.
* „ *Mittenii*, Steph.; also Mosman's Falls.
„ *Novæ-Hollandiæ*, Mitt.; Maitland.
* „ *Novæ-Zelandiæ*, Mitt.
* *Mastigolejeunea phæa*, (Gottsche) Spr.
* *Plagiochila Queenslandica*, Steph.
* *Solenostoma inundatum*, (Mitt.) Steph.
Strepsilejeunea austrina, Spruce; Mosman's Bay.
* *Zoopsis argentea*, Hook. f. et Tayl.

In addition, I am glad to be able to state that the list contained six new species, viz.:—

* *Frullania elongata*, Steph.
* „ *Ferdinandi Muelleri*, Steph.
* „ *Wattsiana*, Steph.
Lepidozia Wattsiana, Steph.; Blue Mts.
* *Lophocolea floribunda*, Steph.
* „ *Levieri*, Steph.

Those marked with an asterisk are Richmond River species.

WEDNESDAY, NOVEMBER 27TH, 1901.

The last Ordinary Monthly Meeting of the Society for the Session was held in the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, November 27th, 1901.

Professor J. T. Wilson, M.B., Ch.M., in the Chair.

Mr. Lawrence Birks, B.Sc., A.M.I.C.E., F.G.S., Sydney, was elected an Ordinary Member of the Society.

A letter from Mrs. Ralph Tate, of Adelaide, thanking the Members of the Society for their expression of sympathy on the occasion of the death of Professor Tate, F.L.S., F.G.S., of the Adelaide University, was read to the Meeting.

Also, a letter from the Tate Memorial Committee in Adelaide, which has in contemplation the erection of a memorial tablet in the Adelaide Museum, and the establishment of a gold medal for University students in Geology.

DONATIONS.

Department of Agriculture, Brisbane—Queensland Agricultural Journal. Vol. ix. Part 5 (November, 1901). *From the Hon. the Secretary for Agriculture.*

Australian Museum, Sydney—Report of the Trustees for the Year 1900. *From the Trustees.*

Department of Mines and Agriculture, Sydney—Agricultural Gazette of New South Wales. Vol. xii. Part 11 (November, 1901). *From the Hon. the Minister for Mines and Agriculture.*

One Separate from the Agricultural Gazette of N.S.W., 1901 (Miscellaneous Publications, No. 497). By W. W. Froggatt, F.L.S. *From the Author.*

Royal Society of New South Wales, Sydney—Abstract of Proceedings. November 6th, 1901. *From the Society.*

Sydney Observatory—Records. No. 158 (Current Papers, No. 5; November, 1900). *From the Director.*

The Surveyor, Sydney. Vol. xiv. No. 6 (November, 1901). *From the Editor.*

Australasian Journal of Pharmacy, Melbourne — Vol. xvi. No. 191 (November, 1901). *From the Editor.*

Field Naturalists' Club of Victoria, Melbourne—Victorian Naturalist. Vol. xviii. No. 7 (November, 1901). *From the Club.*

Royal Geographical Society of Australasia, Victorian Branch. Vol. xix. (1901). *From the Society.*

Conchological Society of Great Britain and Ireland, Manchester — Journal of Conchology. Vol. x. No. 4 (October, 1901). *From the Society.*

Entomological Society of London—Transactions, 1901. Part iii. *From the Society.*

Manchester Museum, Owens College—Museum Handbooks. Publication No. 31. Correlation Tables of British Strata (1901). *From the Museum.*

Royal Gardens, Kew—Hooker's Icones Plantarum. Fourth Series. Vol. viii. Part i. (September, 1901). *From the Bentham Trustees.*

Royal Microscopical Society, London—Journal, 1901. Part 5 (October). *From the Society.*

Royal Society, London — Proceedings Vol. lxviii. No. 450 (September, 1901). *From the Society.*

Zoological Society, London—Proceedings, 1901. Vol. i. Part 2 (March-April): Transactions. Vol. xvi. Part 2 (August, 1901). *From the Society.*

Geological Survey of Canada, Ottawa—Annual Report for 1898, with Maps. Vol. xi. n.s. (1901). *From the Director.*

American Naturalist, Cambridge, U.S.A. Vol. xxxv. No. 418 (October, 1901). *From the Editor.*

Johns Hopkins University, Baltimore—Hospital Bulletin. Vol. xi. No. 115 (October, 1900); Vol. xii. No. 126 (September, 1901). *From the University.*

U.S. Department of Agriculture, Washington—*Division of Biological Survey.* North American Fauna Nos. 20-21 (Aug.-Sept., 1901): *Division of Botany.* Contribution to the U.S. National Herbarium. Vol. vii. No. 2 (1901): *Division of Entomology.* Bulletin. New Series. Nos. 28-30 (1901). *From the Secretary for Agriculture.*

Asiatic Society of Bengal, Calcutta — Journal. Vol. lxix. Part iii. (1900); Vol. lxx. Part i. No. 1; Part ii. No. 1 (1901): Proceedings, 1901, Nos. iii.-viii. (March-August). *From the Society.*

Perak Government Gazette, Taiping. Vol. xiv. Nos. 28-29 (September-October, 1901). *From the Government Secretary.*

Entomologischer Verein zu Berlin—Berliner Entomologische Zeitschrift. xlvi. Band. Heft 2u. 3 (1901). *From the Society.*

Zoologischer Anzeiger, Leipzig. xxiv. Band. Nos. 653-654 (September-October, 1901). *From the Editor.*

Naturforschende Gesellschaft in Bern—Mittheilungen aus dem Jahre 1900 (Nr. 1478-1499). *From the Society.*

Société Helvétique des Sciences Naturelles, à Berne—Actes et Compte Rendu, 82me Session (1899); 83me Session (Berne, 1900). *From the Society.*

Société Géologique de Belgique, Liége—Annales. Tome xxviii. 3e Livraison (1901). *From the Society.*

Société Royale de Géographie d'Anvers—Bulletin. Tome xxv. 3e Livraison (1901). *From the Society.*

Société Royale des Sciences de Liége—Mémoires. 3^{e} Série. Tome iii. (1901). *From the Society.*

Société Impériale des Naturalistes de Moscou — Bulletin. Année 1900. No. 4; Année 1901. Nos. 1-2. *From the Society.*

Journal de Conchyliologie, Paris. Vol xlix. No. 3 (1901). *From the Director.*

College of Science, Imperial University of Tōkyō—Journal. Vol. xiii. Part iv. (1900); Vol. xv. Part iii. (1901). *From the Director.*

Tōkyō Zoological Society—Annotationes Zoologicæ Japonenses. Vol. iv. Part i. (August, 1901). *From the Society.*

La Nuova Notarisia, Padova—Serie xii. Ottobre, 1901. *From the Editor, Dr. G. B. De Toni.*

Museo de Zoologia ed Anatomia comparata della R. Università di Torino—Bollettino. Vol. xvi. No. 382-403 (Gennaio-Ottobre, 1901). *From the Museum.*

Museo Nacional de Buenos Aires—Comunicaciones. Tomo i. No. 9 (Agostode, 1901). *From the Museum.*

Museu Paraense de Historia Naturale e Ethnographia, Para—Boletim. Vol. iii. No. 2 (Agosto, 1901). *From the Museum.*

Societé Scientifique du Chili, Santiago—Actes. Tome x. 5^{me} Livraison (1900); T. xi. 1re Livraison (1901). *From the Society.*

DESCRIPTIONS OF NEW AUSTRALIAN LEPIDOPTERA.

By Oswald B. Lower, F.E.S., Lond., &c.

ARCTIADÆ.

Lithosinæ.

Ctenosia, Hmpsn.

Proboscis fully developed; palpi porrect, not reaching beyond frons; antennæ of ♂ bipectinate, with short branches ending in a bristle; tibiæ with moderate spurs; abdomen clothed with rough hair. Forewing narrowly elongate; vein 2 from towards end of cell, oblique; 3 and 4 on a long stalk; 6, 7, 8 and 10 stalked; 9 absent; 10 from beyond 7; 11 free. Hindwings somewhat broader than forewings; 2 from towards end of cell; 3 and 4 stalked; 5 absent; 6 and 7 stalked; 8 from middle of cell.

The genus was founded on an African species, *C. psectriphora*, Distant. The present species is a very obscure-looking insect. I am indebted to Sir Geo. Hampson, Bart., of the British Museum, for the correct location of this and many other species described in this paper.

Cten. infuscata, n.sp.

♂. 20-25 mm. Head, palpi, antennæ, thorax and legs dull greyish-ochreous. Abdomen fuscous, densely clothed with fine greyish-ochreous hairs. Forewings elongate, termen bowed, oblique; dull greyish-ochreous; costa narrowly fuscous on basal half; a moderate obscure and somewhat suffused fuscous fascia from ⅔ of costa to ⅗ inner margin, anterior edge moderately defined, posterior edge obscure and tending to be continued along veins to termen: cilia greyish-ochreous. Hindwings with termen rounded; light fuscous, becoming narrowly ochreous along inner margin; cilia as in forewings, but ochreous along inner margin.

Broken Hill, N.S.W.; two specimens, in April.

CAPRIMIMA SCRIPTA, n.sp.

♂. 16 mm. Head, palpi, thorax and abdomen dull whitish. Antennæ and legs fuscous. Forewings elongate-ovate, costa strongly arched, termen bowed, oblique; 10 and 11 separate; dull white, markings fuscous; a small spot at base of costa; a larger costal spot beyond, connected by a fine costal streak; a small spot below and between; an irregular transverse series of spots, from costa before middle to inner margin at ⅓, becoming divided into two fine lines on lower half; a similar fascia from before apex to before anal angle, strongly curved outwards in middle, and followed throughout by a fine parallel line; a dot on costa between the two fasciæ, and a smaller one below; a spot on middle of termen: cilia dull whitish. Hindwings with termen rounded; light fuscous, paler on basal half; cilia as in forewings.

Duaringa, Q.; one specimen, in November.

This species will come in Hampson's genus *Caprimima*, Section ii., formerly classed as *Chiriphe*, Walk., by Meyrick and other Australian writers.

NOCTUIDÆ.

Argotinæ.

CANTHYLIDIA MESOLEUCA, n.sp.

♀. 26 mm. Head, palpi, antennæ, thorax and abdomen greyish-ochreous; palpi white on basal ⅔. Legs grey-whitish. Forewings elongate-triangular, termen obliquely rounded, faintly waved; ochreous-fuscous; a moderate silvery-white longitudinal supra-median streak from ⅓ from base to termen, attenuated anteriorly; a fine similarly coloured streak above posterior third of previous streak; a fine, somewhat bowed, streak below middle, from base to termen above anal angle; a fine silvery-white line along inner margin: cilia fuscous. Hindwings with termen faintly waved; whitish, thinly scaled, with a suffused fuscous band along termen, more pronounced on upper half; cilia white.

Broken Hill, N.S.W.; one specimen, in March.

Allied to *cramboides*, G'n., but separated from that species by the greater number and position of the silvery-white lines.

C. ALEUROTA, n.sp.

♂. 20 mm. Head, palpi and thorax greyish-white, palpi white beneath. Antennæ ochreous. Abdomen grey. Legs greyish, coxæ clothed with snow-white hairs. Forewings elongate-triangular, termen faintly waved, obliquely rounded; dull whitish-grey; an obscure series of fuscous dots from costa at ¾ to inner margin at about ⅔, faintly curved outwards on upper third: cilia greyish-fuscous. Hindwings with termen irregularly waved; greyish, becoming broadly suffused with fuscous along termen, especially on upper half; cilia white, with a faint fuscous subbasal line.

Nearest *moribunda*, G'n., but much narrower-winged and more whitish in colour, in this respect approaching *pallida*, Butl.

C. ANEMODES, n.sp.

♂. 22 mm. Head, palpi, antennæ and thorax ochreous-grey, palpi whitish at base beneath. Abdomen and legs fuscous. Forewings elongate-triangular, termen faintly waved, obliquely rounded; pale ochreous, becoming slightly darker on middle of inner margin: cilia pale ochreous-white, becoming more ochreous at base. Hindwings with termen irregularly waved; clear white, thinly scaled; cilia white, faintly ochreous-tinged at base.

Derby, W.A.; two specimens, in November.

Separable from all the above by the clear white hindwings.

AGROTIS (?) SPILONATA, n.sp.

♀. 35 mm. Head, palpi, antennæ and thorax ochreous, fuscous-tinged. Abdomen grey-whitish, finely irrorated with fuscous, especially beneath. Legs whitish, finely irrorated with reddish-fuscous. Forewings elongate-triangular, termen waved, obliquely rounded; brownish-ochreous; veins more or less outlined with fuscous; median third of wing fuscous, more pronounced on upper half; orbicular moderate, ovoid, white, faintly centred with fuscous; reniform large, well developed, white, broadly centred with fuscous; a fine fuscous waved line along termen: cilia ochreous, with subbasal and terminal fuscous lines. Hindwings with termen rounded, waved; iridescent-white, termen more or less faintly infuscated; cilia white.

Blackwood, S.A.; one specimen, in March.

AGROTIS (?) AMAURODES, n.sp.

♀. 36 mm. Head, palpi, antennæ and thorax whitish, palpi short, white beneath. Abdomen grey-whitish, finely irrorated with fuscous. Legs fuscous. Forewings elongate-triangular, termen faintly waved, somewhat bowed, oblique; dull whitish-fuscous, more or less irrorated with darker fuscous and a few ferruginous scales; 5 small black spots on costa between base and reniform spot, from first proceeds a short waved fuscous double line, only perceptible on upper half; a similar line proceeding from second and third spots and ending on inner margin at $\frac{1}{3}$, a similar line from beyond $\frac{2}{3}$ of costa to inner margin at $\frac{3}{4}$, followed by a broad fuscous parallel shade, posterior edge irregularly waved, and indented beneath costa; ground colour between shade and termen bluish-white; a fine waved line along termen; orbicular small, indistinct, roundish, whitish; reniform small, white, broadly edged on either side, except posterior edge, with black: cilia greyish, with a fuscous median line. Hindwings with termen rounded, hardly waved; light fuscous, becoming whitish on basal half, division suffused; cilia white, with a fuscous median line.

Toorak, Vic.; two specimens, in March.

AGROTIS MNIODES, n.sp.

♂. 30 mm. Head and thorax greyish, thorax with a transverse black anterior line. (Palpi broken). Antennæ bipectinated to apex, ochreous. Abdomen and legs grey-whitish, tibiæ blackish, ringed with whitish. Forewings elongate-triangular, termen faintly waved, hardly oblique, nearly straight; grey-whitish, very faintly tinged with dull olive-greenish; first line double, waved, black, interspace ochreous-white; second line similar, followed by a black cartridge-shaped spot on fold; postmedian shade moderate, irregularly waved, fuscous, becoming blackish beyond reniform; a subterminal row of cuneiforn black spots, edged posteriorly by a waved whitish line; orbicular moderate, whitish, ovoid, edged on anterior and posterior edges with blackish; reniform large, whitish-fuscous, connected with orbicular by a thick black shade; a row of black lunate marks along termen: cilia greyish, with fuscous subbasal and terminal lines. Hindwings with termen irregularly waved; fuscous-whitish, becoming darker along termen; a row of lunate marks along termen; cilia white.

Broken Hill, N.S.W.; one specimen, in November.

AGROTIS (?) PAUROGRAMMA, n.sp.

♀. 32 mm. Head, palpi and thorax dark reddish-fuscous, thickly irrorated with white. Antennæ fuscous. Abdomen and legs whitish-fuscous. Forewings elongate-triangular, termen faintly waved, oblique, gently rounded; dark reddish-fuscous, thickly irrorated with fine white hair-scales; veins more or less outlined with black, especially towards termen and base: cilia dark reddish-fuscous, with a darker median line. Hindwings with termen irregularly waved, somewhat sinuate between veins 4 and 6; light fuscous, darker along termen, and becoming whitish towards base; cilia white.

Derby, W.A.; two specimens, in November.

Mamestrinæ.

MAMESTRA DICTYOTA, n.sp.

♂. 34 mm. Head, palpi and thorax dark fuscous, mixed with whitish, patagia white. Antennæ, legs and abdomen dark ochreous-fuscous, tarsi obscurely ringed with whitish. Forewings elongate-triangular, termen faintly waved, gently rounded, oblique; dark fuscous, mixed with blackish; first line waved, double, black, interspace white; second line black, moderate, thickest on fold, edged anteriorly by its own width of white, postmedian white, divided into spots which are black-edged anteriorly; subterminal white, waved, moderate, edged anteriorly by a series of cuneiform interneural black spots; a row of cuneiform black spots along termen; orbicular round, moderate, black, ringed with white; reniform moderate, white, with a transverse fuscous streak in centre: cilia fuscous, with a blackish median line, base ochreous. Hindwings with termen faintly waved; dark fuscous, becoming whitish towards base; cilia white, with a fuscous median line.

Melbourne, Vic.; one specimen, in December.

LEUCANIA LEUCOSTA, n.sp.

♂. 30 mm. Head, palpi, thorax, antennæ and legs pale reddish, abdomen reddish-grey, anal tuft reddish. Forewings elongate-triangular, termen nearly entire, gently rounded, oblique; deep reddish-ferruginous; lines fuscous, hardly traceable; a round white spot at posterior extremity of cell; a narrow well defined white streak along costa throughout; a row of fine black dots along termen: cilia deep reddish, becoming lighter at base. Hindwings with termen irregularly waved; white, veins towards termen outlined with dull red; a suffused coppery-fuscous narrow band along upper ⅔ of termen, broadest at apex; cilia pale reddish, with a fine whitish basal line, becoming wholly white on lower third.

Mackay, Q.; Parkside, S.A.; two specimens, in March.

LEUCANIA EUTHERMA, n.sp.

♀. 25 mm. Head, palpi, antennæ and thorax light ochreous-fuscous. Abdomen and legs greyish-ochreous. Forewings elongate-triangular, termen evenly waved; light ochreous-fuscous, somewhat shining; markings fuscous; a few ill-defined spots along costa; a short streak along fold at base; a transverse row of small spots, from costa at ¼ to inner margin at ¼; a slightly outwards-curved row of similar spots from costa at ⅔ to inner margin at ⅔; a row of fine elongate black spots along termen: cilia fuscous, with a light ochreous basal line. Hindwings with termen irregularly waved; fuscous, becoming whitish-fuscous on basal third; cilia whitish-ochreous, becoming fuscous on basal half.

Parkside, S.A.; three specimens, in October.

Caradrininæ.

EREMOCHROA PARADESMA, n.sp.

♂♀. 28-32 mm. Head, palpi, antennæ and thorax ochreous-fuscous. Abdomen and legs ochreous-whitish. Forewings elongate-triangular, termen entire, gently rounded, oblique; ochreous-fuscous; subbasal line hardly traceable; first and second lines waved, fuscous, edged externally with whitish; orbicular large, roundish, whitish-ochreous, centred and edged with fuscous; reniform moderate, strongly excised on sides, edged with blackish, space between spots darker; subterminal whitish, edged anteriorly by a fuscous spot-like line of its own width; an interrupted blackish line along termen: cilia ochreous-fuscous, faintly barred with whitish. Hindwings with termen irregularly rounded; pale whitish-ochreous, with a dull fuscous band along termen, a broad fuscous subterminal shade, and indications of a submedian fuscous shade; cilia whitish, sparsely mixed with fuscous.

Parkside, S.A.; three specimens, in October.

May possibly prove to be a variety of *alphitias*, Meyr., but I think not.

PROMETOPUS MELODORA, n.sp.

♂♀. 30 mm. Head, palpi, antennæ and thorax blackish, palpi beneath whitish-grey. Abdomen and legs grey, tarsi blackish, obscurely ringed with whitish. Forewings elongate-triangular, termen faintly waved, obliquely rounded; blackish; subbasal line not traceable, first and second lines waved, black, starting on costa from small yellowish spots; subterminal formed by a series of dull ochreous spots; veins beyond second line more or less outlined with black; orbicular very small, round, dull ochreous; reniform moderate, white, anteriorly edged with ferruginous, lower lobe filled in with black; a row of black, ochreous-edged elongate spots along termen: cilia ferruginous-fuscous, with a black subbasal line. Hindwings with termen irregularly rounded; whitish-fuscous, becoming darker on terminal half; a transverse fuscous discal spot; an interrupted fuscous line along termen; cilia white.

Broken Hill, N.S.W.; Parkside, S.A.; common in October and April.

PROMETOPUS CORNUTA, n.sp.

♀. 30 mm. Head, palpi and thorax ashy-grey-whitish, thorax whiter anteriorly, palpi blackish on basal half of second joint. Antennæ blackish. Abdomen and legs grey, anterior legs infuscated, all tarsi blackish, obscurely ringed with whitish. Forewings elongate-triangular, termen faintly waved, rounded, oblique; dark fuscous, sprinkled with whitish, ochreous, and ferruginous; subbasal lines black, waved, short; first and second lines black, waved, anteriorly edged with whitish; subterminal black, edged internally with whitish, and posteriorly by a broad dark fuscous shade, somewhat indistinct on lower half, and containing a series of black elongate points on its posterior edge, more distinct in middle, veins beyond faintly outlined with fuscous; orbicular small, round, ochreous, finely edged with blackish; reniform moderate, somewhat quadrate, lower edge with an elongate projection, yellowish, suffusedly edged with fuscous: cilia ashy-grey-fuscous, with a row of dark fuscous spots at base. Hindwings with termen faintly waved, iridescent-whitish, more or less suffused with light fuscous, especially round termen and towards apex; cilia white.

Parkside, S.A.; several specimens, in April.

PROMETOPUS SARCOMORPHA, n.sp.

♀. 26 mm. Head, palpi and thorax fleshy-pink, collar blackish, palpi beneath whitish. Antennæ fuscous. Abdomen and legs greyish, finely sprinkled with fuscous, tarsi fuscous. Forewings elongate-triangular, termen very faintly waved; fleshy-white, becoming more reddish beyond subterminal; basal line moderately thick, black; first and second lines fine, black, waved, first strongly dentate, both starting from black spots on costa; subterminal obscure, not traceable; orbicular ferruginous, small, roundish; reniform somewhat crescentic, whitish, anterior half-filled in with reddish-ferruginous; an interrupted black line along termen: cilia fuscous, mixed with whitish. Hindwings with termen faintly waved; fuscous, becoming lighter towards base; a faint fuscous discal dot; cilia whitish, with a faint fuscous subbasal line.

Gisborne, Vic.; Broken Hill, N.S.W.; two specimens, in April.

Allied to *miltoneura*, Lower, differing chiefly in the absence of subterminal black spots and darker hindwings.

PROMETOPUS CYANOLOMA.

♀. 32 mm. Head, palpi and thorax ochreous, palpi whitish beneath, blackish on sides at base. Antennæ, abdomen and legs greyish-ochreous, tarsi fuscous. Forewings elongate-triangular, termen very faintly waved, obliquely rounded; pale clear ochreous; basal, first and second lines not traceable, only indicated by a few scattered black spots; orbicular minute, whitish; reniform roundish, suffused, whitish, almost entirely concealed by a large well marked blackish shade; a small black spot, edged with whitish, just above; subterminal preceded by a row of short black neural streaks, most prominent on middle; space between this and termen clear bluish-white; a row of small black dots along termen: cilia ochreous. Hindwings with termen faintly waved; whitish-fuscous, becoming broadly light fuscous along termen; cilia white, with a greyish subbasal line.

Melbourne, Vic.; one specimen, in April.

PROMETOPUS PETRODORA, n.sp.

♀. 36 mm. Head, palpi and thorax whitish, sprinkled with grey. Antennæ fuscous. Abdomen and legs greyish, tarsi fuscous. Forewings elongate-triangular, termen very faintly waved, obliquely rounded; whitish, more or less irrorated throughout with light greyish-fuscous; basal and second lines black, waved, faintly indicated; first line black, waved, preceded by three blackish spots; subterminal light fuscous, preceded by a transverse row of elongate black marks on veins; orbicular not discernible; reniform small, white, anteriorly edged with fuscous and with a fuscous suffusion beneath; a row of blackish spots along termen: cilia whitish. Hindwings iridescent-whitish, becoming fuscous around termen and apex; cilia iridescent-white.

Parkside, S.A.; three specimens, in April.

PROMETOPUS ENDESMA, n.sp.

♂. 32 mm. Head, palpi, antennæ and thorax light ochreous-fuscous, collar narrowly dark fuscous in front, rather broadly whitish behind, palpi fuscous on sides at base, antennal pectinations 1½. Abdomen greyish. Legs fuscous-greyish. Forewings elongate-triangular, termen very faintly waved, obliquely rounded; light brownish-ochreous, more or less mixed with fuscous, except terminal area which is clear ochreous-brown throughout; basal and first lines little indicated; second line dentate, black; subterminal dark fuscous, edged anteriorly by a row of black elongate spots: orbicular round, yellowish, edged with black; reniform very large, white, somewhat crescentic posteriorly, containing a fuscous line in centre which becomes somewhat broad below; a black streak along fold near base; an interrupted fine fuscous line along termen: cilia ochreous-fuscous. Hindwings with termen very faintly waved; iridescent-white; an elongate-crescentic fuscous discal spot; an obscure submedian series of fuscous dots; cilia whitish, with some fuscous spots at extremities of veins.

Parkside, S.A.; two specimens, in April.

CARADRINA MICROSPILA, n.sp.

♂. 26 mm. Head, palpi and thorax dark fuscous, palpi greyish internally. Antennæ, abdomen and legs fuscous-greyish, tarsi fuscous, obscurely ringed with whitish. Forewings elongate-triangular, termen hardly waved, obliquely rounded; dark fuscous;

lines black, waved, starting from light ochreous costal spots; basal followed by a faint ochreous line; first and second well marked; subterminal with moderate projection above inner margin, followed throughout by a broad blackish shade, with some elongate spots in middle; a black streak along fold; orbicular minute, white, blackish-edged; reniform small, white, divided in middle by a fine fuscous streak: cilia dark fuscous, lighter along base. Hindwings with termen faintly waved; light fuscous, becoming gradually darker towards termen and apex; a faint fuscous discal spot; cilia whitish, with a fuscous subbasal line.

Parkside, S.A.; three specimens, in April.

Caradrina microdes, n.sp.

♀. 22 mm. Head, palpi, antennæ and thorax dark fuscous. Abdomen ochreous. Legs fuscous-whitish, tarsi blackish ringed with white. Forewings elongate-triangular, termen hardly waved; dark fuscous; lines black, moderately developed, basal first and median waved, starting from black spot on costa, first preceded by a light fuscous parallel line, median thicker, second followed by an ochreous-fuscous parallel shade; subterminal indistinct; orbicular somewhat ovoid, reddish; reniform moderate, white, edged above and below with blackish, groundcolour above somewhat lighter: cilia fuscous. Hindwings with termen faintly waved; fuscous-whitish, becoming paler on basal half; cilia whitish, with a fuscous subbasal line.

Broken Hill, N.S.W.; several specimens, in May.

Caradrina etoniana, n.sp.

♂. 40 mm. Head black. Face and palpi whitish, palpi blackish on sides. Thorax black, collar broadly grey-whitish. Abdomen greyish-fuscous. Antennæ fuscous, ciliated. Legs fuscous, anterior and middle coxæ black, all tarsi fuscous, ringed with whitish. Forewings elongate-triangular, termen faintly waved, obliquely rounded; dark fuscous, strongly suffused with blackish; costal edge spotted with yellowish; subbasal indistinct; first and second lines black, dentate, first with long projection outwards on fold, edged throughout anteriorly with dull whitish; second regularly dentate throughout; subterminal dentate, anteriorly edged with a broad black shade, with black lines along veins on upper half; orbicular minute, yellowish, dot-like; reniform very large, orange-reddish, lower third filled in with black; terminal area of wing broadly dark brown; a row of dull ochreous spots at extremities of veins: cilia blackish. Hindwings iridescent-white; a few fuscous streaks on veins towards termen; a blackish apical patch; cilia iridescent-white, becoming fuscous round apical patch.

Parkside, S.A.; one specimen, in March.

CARADRINA PARAGYPSA, n.sp.

♀. 34 mm. Head, palpi and thorax fuscous, collar whitish, anterior half fuscous, thorax with a broad longitudinal whitish median patch. Abdomen and antennæ greyish. Legs fuscous-grey, tarsi fuscous, obscurely banded with ochreous. Forewings elongate-triangular, termen broadly waved, obliquely rounded; dark fuscous; all lines lost in general groundcolour; a very broad white subcostal streak, from base to $\frac{3}{4}$, becoming mixed with groundcolour on posterior extremity, a similar narrower streak above fold, from base to lower edge of reniform, edged below on anterior half with black; a short whitish streak at base, just above inner margin; terminal area of wing brownish; orbicular small, round, white; reniform moderate, white, with a fine fuscous transverse line through middle; a fine blackish line along termen: cilia dark fuscous. Hindwings with termen hardly waved; iridescent-whitish, strongly infuscated on terminal half; discal spot and submedian dots fuscous, moderately developed; cilia iridescent-white.

Parkside, S.A.; three specimens, in June.

CARADRINA CHRYSOSPILA, n.sp.

♀. 28 mm. Head and thorax dark fuscous, collar whitish, broadly fuscous on anterior half, thorax lighter in middle. Palpi grey, fuscous on sides at base. Abdomen fuscous. Legs whitish, tarsi fuscous, banded above with ochreous. Forewings elongate-triangular, termen faintly waved, obliquely rounded; dark fuscous, more or less irrorated with dull whitish, especially on basal two-thirds; all lines obsolete; an elongate thick black streak along fold to ⅓, orbicular and reniform placed on a black shade; orbicular small, round, ochreous; reniform ochreous, well developed; terminal area of wing light brownish-ochreous, edged anteriorly by blackish shade of groundcolour; an interrupted blackish line along termen: cilia fuscous. Hindwings with termen faintly waved; fuscous, lighter towards base; discal spot fuscous; cilia whitish with a fuscous subbasal line.

Parkside, S.A.; two specimens, in April.

CARADRINA OXYGONA, n.sp.

♂. 30 mm. Head and thorax fuscous, collar whitish, anteriorly broadly fuscous. Antennæ and palpi greyish, palpi blackish on sides towards base. Abdomen fuscous. Legs whitish, tarsi fuscous, banded above with ochreous. Forewings elongate-triangular, termen very faintly waved, obliquely rounded; slaty-grey, mixed with fuscous; subbasal black, thick, waved; first line thick, black, angulated above and below middle, edged anteriorly throughout with dull whitish; median indistinct, joining second on inner margin; second evenly waved throughout, black; subterminal blackish, edged anteriorly with elongate black marks on veins; terminal area of wing broadly dull bluish-white; orbicular small, ochreous, finely edged with black; reniform large, whitish, ochreous-tinged anteriorly, and edged suffusedly with blackish, rather broadly anteriorly: cilia fuscous, with an ochreous basal line. Hindwings with termen faintly waved; light fuscous, becoming whitish towards base; cilia white, with a fuscous subbasal line.

Blackwood, S.A.; one specimen, in April.

CARADRINA MACULATRA, n.sp.

♀. 30 mm. Head and palpi fuscous-whitish, palpi black on sides on basal half. Thorax and antennæ grey. Abdomen light fuscous. Legs grey, tarsi fuscous, banded with ochreous above. Forewings elongate-triangular; termen almost entire, obliquely rounded; greyish, lines fuscous; subbasal first and second waved; first indented below middle; second curved outwards on upper $\frac{2}{3}$; median obsolete; orbicular obsolete; reniform obscure, fuscous; a well marked quadrate black spot touching middle of subterminal line anteriorly; subterminal faintly indicated; an obscure row of blackish dots along termen: cilia ochreous-fuscous, lighter at base. Hindwings and cilia dull whitish.

Brisbane and Mackay, Q.; three specimens, in December and March.

CARADRINA MONOCHROA, n.sp.

♀. 32 mm. Head, thorax and abdomen brownish-ochreous. Palpi greyish-fuscous. Legs whitish, tarsi fuscous. Forewings elongate-triangular, termen almost entire, obliquely rounded; brownish-ochreous; lines faint, blackish; subbasal and first hardly traceable; second evenly dentate throughout, gently curved outwards; subterminal fine, orbicular and reniform spots obsolete: cilia brownish-ochreous. Hindwings with termen faintly waved; fuscous, becoming darker on terminal half; cilia whitish, with a fuscous subbasal line.

Parkside, S.A.; five specimens, in April.

CARADRINA PORPHYRESCENS, n.sp.

♀. 38 mm. Head, palpi and thorax dull reddish, faintly purplish-tinged. Antennæ and abdomen greyish-fuscous. Legs greyish, anterior and middle coxæ reddish-tinged, tarsi fuscous, banded above with ochreous. Forewings elongate-triangular, termen almost entire, obliquely rounded; dull reddish, with purplish reflections: lines faint, fuscous; subbasal obsolete; first and median waved, only traceable on lower half; second line faintly waved throughout, nearly straight; subterminal edged anteriorly by a moderate fuscous shade throughout: terminal area of wing lighter than groundcolour: cilia fuscous. Hindwings with termen faintly waved; fuscous, somewhat shining, becoming lighter on basal half; a fuscous discal spot; cilia whitish, with a fuscous subbasal line, more distinct on upper half.

Melbourne, Vic.; two specimens, in November.

CARADRINA ATRISQUAMATA, n.sp.

♀. 28 mm. Head, palpi, antennæ and thorax fuscous, palpi greyish beneath, blackish on sides towards base. Abdomen greyish. Legs grey-whitish, tarsi fuscous, more or less banded above with ochreous. Forewings elongate-triangular, termen nearly entire, obliquely rounded; dark fuscous; lines blackish, moderately defined; first evenly waved, nearly straight; median and second waved, curved outwards on upper half; parallel; subterminal obscure, nearly straight; orbicular and reniform obscure, little developed, whitish; some blackish scales along termen: cilia fuscous. Hindwings light fuscous, becoming lighter on basal half; cilia whitish, with a fuscous subbasal line.

Melbourne, Vic.; two specimens, in April.

CARADRINA EUCHROA, n.sp.

♂. 26 mm. Head, thorax and antennæ light ochreous-whitish, collar narrowly fuscous anteriorly. Palpi fuscous. Abdomen and legs grey-whitish, anterior tibiæ banded with fuscous, all tarsi fuscous, banded above with ochreous. Forewings elongate-triangular, termen nearly entire, obliquely rounded; light ochreous, mixed with light fuscous and whitish; subbasal, median and second lines obsolete; first line blackish, twice angulated; subterminal blackish, anteriorly edged by a broad blackish shade, more pronounced on upper half; costa spotted with blackish and alternate spots of groundcolour; a fine black line along fold, from base to $\frac{1}{4}$; orbicular hardly noticeable, light ochreous; reniform moderate, white, anteriorly preceded by a line of groundcolour, only separated by a curved black line; cellular space between orbicular and reniform black; an obscure fuscous line along termen: cilia ochreous, tinged with fuscous. Hindwings with termen almost entire; pale ochreous-whitish, somewhat infuscated along termen; an obscure fuscous discal dot; submedian and subterminal lines faintly indicated, fuscous; a fuscous line along termen; cilia whitish.

Parkside, S.A.; one specimen, in April.

CARADRINA ADELPHODES, n.sp.

♂. 28 mm. Head, antennæ and thorax light ochreous-fuscous, thorax darker anteriorly. Palpi greyish, blackish beneath on basal ⅔. Abdomen and legs light greyish, finely sprinkled with fuscous, tarsi fuscous, faintly banded with ochreous above. Forewings elongate-triangular, termen entire, obliquely rounded; light ochreous-fuscous; all lines blackish, obscurely indicated, first with moderate projection along fold, second evenly waved throughout, gently curved inwards below middle; subterminal very similar; orbicular small, round, white; reniform rather small, somewhat flattened; cellular space blackish; an obscure interrupted fuscous line along termen: cilia ochreous-fuscous, with a fuscous median line. Hindwings and cilia clear iridescent-whitish.

Broken Hill, N.S.W.; two specimens, in April.

Allied to the preceding, but easily separated by the clear whitish hindwings.

CARADRINA CRYPSICHARIS, n.sp.

♂. 32 mm. Head, antennæ and thorax ochreous-grey, thorax infuscated anteriorly and with two fuscous longitudinal lines, collar fuscous anteriorly. Palpi greyish, blackish on basal ⅔. Abdomen and legs greyish-fuscous, tarsi fuscous, anterior pair banded above with ochreous. Forewings elongate-triangular, termen very faintly waved; light ochreous, suffusedly irrorated with fuscous on median third; all lines, except subterminal, obsolete; subterminal blackish, waved, edged anteriorly with a moderate blackish shade; some black dots along costa; veins towards middle of subterminal outlined with blackish; orbicular small, roundish, ochreous, finely edged with black; reniform somewhat quadrate, edged anteriorly by a streak of lighter groundcolour, separated from spot by a fine black line; cellular space dark fuscous; a row of black dots along termen: cilia ochreous-grey. Hindwings whitish, irrorated with light fuscous along termen and apex; discal dot and submedian fuscous, faintly indicated; cilia whitish.

Var. *senta.*

Forewings unicolorous, ochreous, all lines except subterminal, which is faintly indicated, obsolete; orbicular, reniform and terminal dots absent. Hindwings and cilia faintly ochreous-tinged.

Parkside, S.A.; five specimens, including two of the var, in April.

CARADRINA PARATORNA, n.sp.

♂. 34 mm. Head, face, palpi and thorax chalky-whitish, palpi fuscous on sides at base. Antennæ ochreous-whitish. Abdomen greyish. Legs white, tarsi fuscous, banded above with ochreous. Forewings elongate-triangular, termen faintly waved, obliquely rounded; dull whitish-grey; subbasal, first and median lines obsolete; second gently waved throughout, fuscous, nearly straight; subterminal fuscous, with black points on veins, space between second and subterminal fuscous; a row of fine black dots along termen; orbicular and reniform hardly perceptible, ochreous: cilia dark fuscous, terminal half greyish-fuscous. Hindwings light fuscous, becoming whitish-fuscous on basal half; cilia white, fuscous-tinged around apex.

Parkside, S.A.; two specimens, in April.

ACRAPEX EXSANGUIS, n.sp.

♂. 20 mm. Head whitish. Palpi and thorax pale flesh-colour. (Abdomen broken). Antennæ ochreous. Legs whitish. Forewings elongate-triangular, termen nearly straight, oblique; fleshy-ochreous; all veins faintly outlined in white: cilia white, with a fuscous subbasal line. Hindwings with termen rounded, faintly sinuate above middle; clear white; cilia white, with faint fuscous subbasal line.

Mackay, Q.; one specimen, in November.

Noctuinæ.

POLYDESMA IGNEIPICTA, n.sp.

♂. 36 mm. Head, palpi, thorax and abdomen dark fuscous, mixed with reddish. Legs greyish, tarsi fuscous, banded above with ochreous. Antennæ fuscous. Forewings elongate-triangular, termen strongly waved, obliquely rounded; dark fuscous, strongly mixed with reddish-cupreous; costa spotted alternately with blackish and reddish-cupreous; lines moderately thick, black; subbasal and second waved, edged posteriorly with reddish-cupreous; first similar, edged anteriorly with reddish-cupreous; subterminal evenly waved, nearly straight, edged posteriorly by a fine reddish line; orbicular and reniform reddish, finely edged with blackish; a fine black lunulate line along termen: cilia reddish-fuscous. Hindwings with termen waved, colour and markings as in forewings, but subbasal, first and median lines not indicated; cilia as in forewings.

Broken Hill, N.S.W.; Derby, W.A.; four specimens, in April. Near *marmarinopa*, Meyr.

CORRHA PANDESMA, n.sp.

♀. 36 mm. Head, palpi, thorax, antennæ, legs and abdomen dark fuscous, tarsi banded with ochreous. Forewings elongate-triangular, termen crenulate, very oblique, gently rounded; dark greyish-fuscous; basal area blackish, limited by first line which is moderately waved, with projections above middle and on fold; median line fuscous, only traceable on upper third; second line evenly waved throughout, followed by a broad blackish parallel shade; a submarginal row of black dots; a strongly waved blackish line along termen: cilia greyish-fuscous, with a waved fuscous subbasal line. Hindwings with termen crenulate, colour along termen, posterior shade, submarginal dots, terminal line and cilia as in forewings; basal ⅔ of wing dull ochreous-fuscous, second line faintly indicated.

Blackwood, S.A.; one specimen, in April.

PROROCOPIS EUXANTHA, n.sp.

♀. 34 mm. Head, palpi, antennæ and thorax cinereous-fuscous. Abdomen dull ochreous. Legs whitish-ochreous, anterior pair fuscous. Forewings elongate-triangular, termen finely waved, oblique, hardly rounded; ashy-grey-whitish, crossed by numerous faint fuscous transverse lines; lines black, narrow, slightly waved; subbasal reaching fold, first nearly straight, median meeting second in middle, second with a rounded projection in middle, thence strongly inwards to meet median, and ending on inner margin about middle; subterminal faintly edged with whitish; a fine waved black line along termen: cilia fuscous. Hindwings with termen gently waved; yellow; a broad blackish band along termen; cilia yellow. Underside of forewings yellowish, with a broad fuscous band along termen.

Brisbane, Q.; one specimen, in December: Broken Hill, N.S.W., in January.

PROROCOPIS HYPOXANTHA, n.sp.

♂. 36 mm. Head, palpi, antennæ and thorax light greyish-fuscous, collar somewhat ferruginous in front, narrowly black behind. Abdomen greyish-ochreous. Legs greyish, tarsi fuscous, banded obscurely with ochreous. Forewings elongate-triangular, termen gently waved, gently rounded, oblique; light greyish-fuscous; lines fine, black, subbasal dentate, first nearly straight on upper third, angulated outwards below middle, and with a short acute projection just above inner margin; median faint, fuscous, waved, nearly straight; second nearly straight to below middle, thence strongly curved up to touch lower edge of reniform, thence returning to inner margin at ⅔, twice sharply angulated above inner margin; subterminal waved, whitish, posteriorly edged with light fuscous; a fine black crenulate line along termen; orbicular obsolete; reniform very large, bilobed, fuscous, finely edged with black: cilia light fuscous. Hindwings with termen waved; light ochreous; a fuscous discal dot; a broad blackish band along termen, narrowed towards anal angle.

Duaringa, Q.; one specimen, in December.

Erastrianæ.

TARACHE CLERANA, n.sp.

♀. 20 mm. Head, palpi and thorax ochreous-white, thorax fuscous-tinged in middle. Antennæ fuscous. Abdomen ochreous. Legs ochreous-white. Forewings elongate-triangular, termen entire, obliquely rounded; ochreous-white; first, median and second lines obsolete, only indicated by small fuscous quadrate spots on costa; basal line broken into three fuscous dots; a broad fuscous subterminal shade (including subterminal line), anterior edge from costa before apex, thence continued very obliquely to middle of inner margin, with two rounded projections, one in middle and one below; the latter containing some black spots; posterior edge irregular, from apex along termen to anal angle, lower half containing 3 waved lines of groundcolour; an irregular row of black dots along termen, separated from preceding shade by a streak of groundcolour: cilia ochreous-white, with apical, median and small bars of fuscous. Hindwings with termen rounded; yellow; a faint fuscous discal dot; a broad fuscous band along termen, upper edge suffused; cilia ochreous, at base fuscous.

Derby, W.A.; two specimens, in November.

TARACHE HIEROGLYPHICA, n.sp.

♀. 16 mm. Head, palpi and thorax ochreous-white, thorax strongly mixed with fuscous. Abdomen ochreous. Legs whitish ochreous. Antennæ fuscous. Forewings elongate-triangular, termen entire, obliquely rounded; ochreous-white; basal line thick, fuscous, waved; first line thick, irregularly waved, connected with by thick streaks along costa and fold; a fuscous spot just below posterior extremity of costal streak; terminal $\frac{2}{3}$ of wing dark reddish-fuscous, containing a very oblique subterminal series of black spots and a waved streak of groundcolour above anal angle; a narrow oblique fuscous costal streak at $\frac{3}{4}$ of costa, connected with anterior edge of fuscous terminal area of wing, and a roundish spot just below, also touching fuscous area; some black dots along termen: cilia fuscous, mixed with ochreous. Hindwings with termen rounded; ochreous; discal dot fuscous; a broad fuscous band along termen, upper edge suffused; cilia ochreous, base fuscous.

Broken Hill, N.S.W.; two specimens, in October.

Entelianæ.

ENTELIA MONEIDA, n.sp.

♀. 25 mm. Head, palpi, antennæ, thorax and abdomen dark fuscous, palpi greyish internally. Legs dark fuscous, tarsi banded with ochreous. Forewings elongate-triangular, termen evenly waved, obliquely rounded; dark fuscous, mixed with deep ferruginous; first and median lines very thick, black, especially median, nearly straight; second double, blackish, dotted somewhat with ochreous throughout, curved outwards above middle; subterminal sharply dentate throughout, black on upper ⅔, thence indistinctly fuscous; orbicular indistinct, blackish; reniform dull whitish, centred with fuscous; a row of minute white dots along termen: cilia dark fuscous. Hindwings with termen evenly waved; dark fuscous becoming whitish on basal third; terminal dots as in forewings; cilia ferruginous-fuscous.

Cooktown, Q.; two specimens, in October.

PYRALIDÆ.

Gallerianæ.

MELISSOBLAPTES BARYPTERA, n.sp.

♀. 20 mm. Head, palpi and thorax whitish, thorax fuscous in middle. Antennæ, abdomen and legs greyish. Forewings elongate, moderate, costa hardly arched, termen obliquely rounded; fuscous, suffused with fleshy-white; a broad oblique median transverse fascia, darkest on edges, anterior edge finely dentate from ⅓ costa to before middle of inner margin, posterior edge sharply dentate, median third curved outwards, from costa at ¾ to inner margin at ⅔: cilia fuscous-whitish. Hindwings with termen rounded; greyish-fuscous, becoming broadly fuscous along termen and with a fuscous submedian line; cilia fuscous-grey.

Parkside, S.A.; one specimen, in March.

Crambinæ.

CRAMBUS DIANIPHA, n.sp.

♂. 14 mm. Head, palpi, antennæ, thorax and legs fuscous-whitish. Abdomen grey-whitish. Forewings elongate, moderate, costa nearly straight, very oblique, hardly rounded; light fuscous, darkest on costa on apical third; a very broad white longitudinal streak from costa at base to apex, gradually dilated from base to beyond middle, thence somewhat constricted and gradually narrowed to extremity; streak edged below throughout with darker groundcolour; a fine oblique whitish streak before and parallel to termen; an indistinct suffused series of minute fuscous dots along termen: cilia whitish, with a fine fuscous subterminal line. Hindwings whitish-fuscous; cilia white.

Derby, W.A.; one specimen, in November.

SEDENIA ACHROA, n.sp.

♂. 22 mm. Head, palpi, antennæ, thorax and legs dark ochreous-fuscous, posterior legs greyish. Abdomen greyish. Forewings elongate-triangular, termen gently rounded, oblique: greyish-fuscous, strongly mixed with ochreous-fuscous; a moderately thick obscure line from $\frac{1}{4}$ of costa to $\frac{1}{4}$ of inner margin; a line of similar thickness from costa at $\frac{5}{6}$ to below middle of wing, thence strongly curved inwards, and ending at $\frac{2}{3}$ of inner margin: an obsure fuscous subterminal line: cilia fuscous, darkest at base. Hindwings with termen rounded; light grey, somewhat fuscous-tinged along margins; a suffused fuscous line from $\frac{1}{3}$ of costa towards inner margin; a similar line from $\frac{3}{4}$ of costa nearly to anal angle, thence continued shortly above termen; cilia greyish, with a fuscous subbasal line.

Closely allied to *xeroscopa*, Lower, but differs by the darker colour, straight costa and lines on hindwings, which in that species do not reach so far across the wing. This may be a geographical form only, but it seems distinct enough.

SURATTHA BATHROTRICHA, n.sp.

♀. 26 mm. Head, palpi, antennæ and thorax whitish, palpi fuscous above, strongly haired below, patagia ochreous. Abdomen ochreous-fuscous. Legs fuscous, posterior pair whitish. Forewings very elongate, cósta gently arched, termen hardly rounded, strongly oblique; broadly ochreous throughout costal space; lower two-thirds of wing pale whitish-fuscous; all veins neatly outlined with fuscous; a well defined dark fuscous longitudinal streak from base to apex, extremities attenuated, edged below on median third with clearer whitish; a row of blackish dots along termen: cilia whitish. Hindwings with termen rounded; whitish-fuscous; cilia whitish, with a fuscous subbasal line.

Broken Hill, N.S.W.; two specimens, in October.

Mr. Meyrick has pointed out (Trans. Ent. Soc. Lond. 1897, iv., p. 380) that the genus *Surattha*, Walk., as defined by Sir Geo. Hampson (*l.c.*, 1895, p. 965), is not tenable; as vein 5 of hindwings is sometimes present. It is present in one specimen before me; and absent, that is, coincident with 4, in another specimen, so that probably this species is more correctly referable to the genus *Talis*, Guen.

TALIS MACROGONA, n.sp.

♂. 20 mm. Head, palpi, antennæ and thorax ochreous-fuscous, palpi whitish beneath. Abdomen and legs whitish. Forewings elongate, posteriorly moderately dilated, termen hardly rounded, oblique; light brownish; a thick fuscous streak in middle from base to $\frac{1}{3}$; a moderate fuscous fascia from costa at $\frac{1}{3}$ to inner margin at $\frac{1}{3}$ with a long sharp angulation outwards in middle, costa between fascia and base and anterior edge of fascia becoming somewhat ochreous; a suffused quadrate fuscous spot in end of cell; a curved dentate fuscous line, edged posteriorly with ochreous, from $\frac{4}{5}$ of costa to immediately before anal angle; some fuscous elongate streaks between this and termen; a row of fuscous dots along termen: cilia ochreous-fuscous. Hindwings greyish-fuscous; cilia whitish, base darker.

Exeter, S.A.; one specimen, in May.

Phycitinæ.

OLIGOCHROA AMAURA, n.sp.

♂. 25 mm. Head, palpi, antennæ and thorax deep coppery fuscous. Abdomen grey. Legs fuscous. Forewings elongate, moderately dilated, costa arched towards apex, termen gently rounded, oblique; deep coppery-fuscous; a moderately broad oblique blackish fascia, anteriorly edged with dull ochreous, from beyond $\frac{1}{3}$ of costa to before middle of inner margin; more or less continued along inner margin to near anal angle and there followed by an ochreous spot; a row of fine fuscous dots along termen: cilia fleshy-pink. Hindwings with termen rounded; greyish, becoming tinged with fuscous along termen and more prominently at apex; cilia greyish, with a faint fuscous line near base.

Brisbane, Q.; one specimen, in January.

NEPHOPTERYX CHRYSERYTHRA, n.sp.

♂. 16 mm. Head and thorax yellow, head mixed with fuscous. Palpi, antennæ and legs fuscous-purplish. Abdomen yellowish. Forewings elongate, moderately dilated posteriorly, termen hardly rounded, oblique; yellowish-orange, with a few scattered purplish dots, lines not traceable; a moderately broad purplish-fuscous apical patch, anterior edge suffusedly rounded; two faint whitish transverse lines in patch towards termen: cilia purplish, mixed with yellowish. Hindwings with termen rounded; light ochreous, becoming fuscous-tinged on terminal half; a fine fuscous line along termen; cilia fuscous, with a fuscous subbasal line.

Cooktown, Q.; one specimen, in November.

NEPHOPTERYX MONOSPILA, n.sp.

♂. 16 mm. Head, palpi, antennæ and thorax cinereous-fuscous, base of palpi whitish. Abdomen fuscous-whitish. Legs fuscous.

Forewings elongate, moderate, slightly dilated posteriorly; cinereous-fuscous; lines blackish, ill defined; first from ⅓ of costa to ⅓ inner margin, anteriorly suffusedly edged by a blackish shade which is separated from line by a streak of whitish; a large round white spot, lying just above inner margin in middle, touching first line; a blackish transverse discal spot, faintly edged posteriorly with some whitish scales; second line hardly traceable, dot-like, only traceable on margins, faintly edged posteriorly with some whitish scales; a fine blackish line along termen: cilia fuscous, with a dark fuscous subbasal line. Hindwings with termen rounded; whitish-hyaline, thinly scaled, becoming narrowly fuscous along termen; cilia whitish with a fuscous basal line.

Broken Hill, N.S.W.; one specimen, in April.

Not unlike *Tylochares cosmiella*, Meyr.

PHYCITA HEMICALLISTA, n.sp.

♂♀. 20-22 mm. Head, thorax, and abdomen pale ochreous. Antennæ and palpi fuscous, palpi whitish beneath. Legs whitish, fuscous-tinged. Forewings elongate, moderate, dilated posteriorly, termen hardly rounded, little oblique; pale ochreous on basal half of wing, terminal half pale fuscous, mixed with ochreous and shaded with obscure whitish metallic scales; a slightly curved deep purplish-fuscous line from middle of costa to middle of inner margin, anteriorly suffusedly edged with ferruginous; some faint fuscous dots along termen: cilia light ochreous, paler at base. Hindwings with termen rounded; pale whitish-ochreous, almost hyaline, becoming light fuscous along termen; cilia grey, becoming distinctly yellowish along base, and with a fine fuscous subbasal line.

Derby, W.A.; Mackay, Q ; three specimens, in November.

CRYPTOBLABES FERREALIS, n.sp.

♀. 20 mm. Head, palpi, antennæ and thorax pale reddish, palpi paler beneath. Abdomen greyish. Legs reddish; somewhat suffused with whitish. Forewings elongate, moderate, slightly dilated posteriorly, termen gently rounded, oblique; pale fleshy-red; lines lost in groundcolour, a broad white streak along costa from base to apex, suffused at base and beneath throughout into groundcolour; a row of fine fuscous dots along termen : cilia pinkish, with a fuscous submedian line. Hindwings with termen rounded, pale yellowish, thinly scaled; cilia greyish, with a fuscous subbasal line.

Brisbane, Q.; Derby, W.A.; two specimens, in January.

Epipaschianæ.

ORTHAGA PHÆOPTERALIS, n.sp.

♂. 20 mm. Head and thorax ochreous, mixed with some reddish scales. Palpi deep reddish. Antennæ ochreous. Abdomen ochreous, second segment with a narrow black band. Legs reddish-fuscous. Forewings elongate, moderately dilated posteriorly, termen gently rounded, oblique; ochreous, suffusedly irrorated with reddish; costa irregularly marked with fuscous; lines obscure, fuscous; first waved, with three blunt angulations; an obscure fuscous discal spot; second line strongly curved outwards, thrice sharply angulated on lower half; a triangular patch of fuscous, occupying apical portion of wing, anterior edged from ⅔ of costa to above middle of termen; a row of deep reddish dots along termen : cilia ochreous-reddish, irregularly barred with darker reddish. Hindwings with termen rounded; whitish-fuscous, becoming broadly light fuscous along termen and apex; cilia as in forewings.

Duaringa, Q.; one specimen, in November.

Hydrocampinæ.

NYMPHULA TENEBRALIS, n.sp.

♂. 16 mm. Head, palpi, antennæ, thorax and legs fuscous, legs suffused with whitish. Abdomen greyish-fuscous. Forewings elongate, moderately dilated posteriorly, termen rounded, oblique; fuscous, mixed with dull whitish, groundcolour lighter between base and first line; lines whitish; first nearly straight, moderately waved throughout; second moderately waved throughout, with two dentations on lower half; groundcolour between lines darker;

some whitish scales along termen: cilia fuscous. Hindwings with termen rounded; colour, lines and markings as in forewings, base of wing lighter; terminal area faintly reddish-tinged; cilia fuscous-whitish.

Brisbane, Q.; four specimens, in January.

Scoparianæ.

ECLIPSIODES ARGOLINA, n.sp.

♀. 16 mm. Head, palpi, thorax, antennæ and abdomen fuscous, abdomen ochreous-tinged. Legs fuscous-whitish. Forewings elongate, moderately dilated posteriorly, termen gently rounded, oblique; fuscous, irregularly blotched with whitish; first line fine, black, oblique, angulated in middle, edged anteriorly throughout with white; base of wing whitish, blackish on fold; second line fine, waved, obscure, blackish, edged anteriorly by a broader white line throughout, which is dilated and confluent on inner margin with termination of a narrow white transverse streak which proceeds from costa near apex; a broad fuscous shade along termen; a fine whitish terminal line: cilia fuscous. Hindwings with termen rounded; light fuscous, darker towards termen; cilia as in forewings, but strongly mixed with whitish.

Broken Hill, N S.W.; one specimen, in April.

ECLIPSIODES EPIGYPSA, n.sp.

♀. 16 mm. Head, palpi, antennæ and thorax cinereous-fuscous, palpi whitish beneath. Legs fuscous. (Abdomen broken). Forewings elongate, moderately dilated posteriorly, termen gently rounded, rather strongly oblique; cinereous-fuscous, strongly suffused with white; lines fuscous, obscure, first moderate, angulated in middle; second thick, irregular, becoming blotch-like in middle; a moderate fuscous discal spot; two oblique fuscous marks on costa near apex; a row of connected fuscous dots along termen: cilia cinerous-fuscous, with some dark fuscous spots at base. Hindwings with termen rounded; light fuscous, becoming grey whitish on basal half; cilia greyish, with two fuscous lines.

Broken Hill, N.S.W.; one specimen, in September.

Allied to the preceding, but separable by the absence of white streaks, etc.

ECLIPSIODES LEUCONOTA, n.sp.

♀. 20 mm. Head, antennæ and thorax cinereous-fuscous, thorax with a white posterior spot. Palpi dark fuscous. Abdomen fuscous, second segment whitish. Legs whitish-fuscous, tibiæ and tarsi fuscous, obscurely banded with whitish. Forewings elongate, gradually dilated posteriorly, termen gently rounded, oblique; ashy-grey-whitish; lines thick, blackish; first gently curved outwards, anterior edge nearly straight, posterior edge irregularly waved, somewhat suffused; second commencing on costa at $\frac{4}{5}$, slightly waved and curved outwards on upper half, thence strongly inwards curved to beneath 2 posterior discal spots, and ending on inner margin beyond middle; a white, black-edged, roundish spot below costa at $\frac{1}{3}$; 2 similar spots, one above the other, at posterior extremity of cell; a row of fine black dots along termen: cilia ashy-whitish, mixed with fuscous at base. Hindwings with termen rounded; light fuscous, becoming darker along terminal half; cilia white, with a fuscous subbasal line.

Semaphore, S.A.; one specimen, in June.

SCOPARIA STENOPA, n.sp.

♂. 20 mm. Head, palpi, antennæ and thorax brownish-fuscous. Legs fuscous-whitish. (Abdomen broken). Forewings elongate, rather narrow, termen oblique; light fuscous, strongly irrorated with whitish, lines obscurely blackish; first gently curved outwards; second dentate, oblique, only traceable on margins; a suffused blackish streak along fold, from near base to $\frac{1}{3}$; lower edge of cell edged by a fine ferruginous line; an elongate whitish mark in cell, edged below with its own width of black, which colour is continued around posterior extremity of mark where it becomes spot-like; some short black elongate lines towards termen and apex; a row of suffused blackish spots along termen: cilia whitish, with a fuscous subbasal line. Hindwings with termen rounded; grey-whitish, thinly scaled, becoming somewhat darker towards termen; cilia as in forewings.

TETRAPROSOPUS PARACYCLA, n.sp.

♀. 14 mm. Head, palpi, antennæ and thorax cinereous-fuscous, palpi whitish at base beneath. Legs whitish-fuscous. Abdomen greyish, anterior segments ochreous. Forewings elongate, moderately dilated posteriorly, termen gently rounded, oblique; ashy-grey-whitish; lines fine, black, well marked; first nearly straight; second from costa at ¾ strongly curved inwards on lower half and ending on inner margin at ⅔; a fuscous dot near base in middle; a moderate, roundish, whitish spot in end of cell, edged anteriorly with blackish; a row of fine black terminal spots; a row of similar spots along base of cilia: cilia fuscous-whitish, with a fuscous median line.

Broken Hill, N.S.W.; one specimen, in October.

Very distinct by the clearness of markings.

Pyraustinæ.

SYLEPTA CROCOPHANES, n.sp.

♀. 32 mm. Head, antennæ and thorax ochreous, collar yellow. Palpi fuscous, basal ⅔ beneath white. Abdomen ochreous, whitish on sides. Legs whitish, anterior tibiæ and tarsi banded with fuscous. Forewings elongate, moderately dilated posteriorly, termen faintly bowed, oblique; dull yellowish, with fuscous markings; a moderately thick streak along costa, from close to base to apex; first line narrow, faint, gently curved outwards; second thick, from ¾ of costa, strongly angulated outwards in middle, sinuate below middle, and ending on costa at ⅔; a quadrate spot touching lower edge of costal streak just beyond first line; a second similar but larger spot in posterior extremity of cell; terminal area of wing, including apical portion, fuscous: cilia ochreous, with a row of blackish marks at base. Hindwings with termen rounded; colour, cellular spot, and second line as in forewings; first line absent; basal third of wing whitish; a fuscous apical spot; cilia and terminal dots as in forewings.

Mackay, Q.; two specimens, in November.

GLYPHODES MESOZONA, n.sp.

♀. 28 mm. Head whitish. Palpi and antennæ fuscous. Thorax iridescent-whitish. Legs and abdomen whitish. Forewings elongate-triangular, termen rounded, oblique; iridescent-whitish; markings fuscous; a moderately thick streak along costa, from base to ⅓, with two thick projections downwards in middle and at posterior extremity; a broad blackish-edged transverse fascia, slightly curved outwards from middle of costa towards middle of termen, but hardly reaching it; a fine subterminal line, slightly curved inwards on upper third, posterior edge throughout with elongate projections; a fine line along termen: cilia iridescent-whitish. Hindwings with termen rounded; colour as in forewings; a somewhat pyriform median fuscous discal ring; subterminal and terminal lines and cilia as in forewings.

Mackay, Q.; two specimens, in June.

Not unlike a variety of *Dysallacta negatalis*, G'n.

PIONEA ORTHOGRAMMA, n.sp.

♂. 18 mm. Head, palpi, thorax and legs whitish; thorax with a fuscous median quadrate spot, collar ochreous-tinged. Antennæ fuscous. Abdomen ochreous. Forewings elongate, moderately dilated posteriorly; termen oblique; whitish-ochreous; markings fuscous; three moderate transverse fasciæ, first basal, second from ⅓ costa to ⅓ inner margin, connected with first on costa by a fuscous streak; third irregular, from ⅔ of costa to ⅔ inner margin, slightly oblique and blotch-like on upper half, thence narrower and straight on lower half, where it is joined by lower half of subterminal and appears double; subterminal gently curved, dot-like on upper half; upper half of terminal area fuscous, with a row of whitish dots near termen: cilia ochreous-whitish, posterior half fuscous. Hindwings with termen rounded; yellow; a broad fuscous band along termen; cilia fuscous, ochreous around anal angle.

Broken Hill, N.S.W.; one specimen, in November.

Not unlike a specimen of *Eclipsiodes crypsixantha*, Meyr., one

PIONEA MONOPHAËS, n.sp.

♂. 25 mm. Head, palpi, antennæ aud thorax light ochreous-fuscous, palpi beneath snow-white. Abdomen darker ochreous-fuscous. Legs pearly-white, anterior infuscated. Forewings elongate, moderately dilated posteriorly, termen oblique, hardly rounded; unicolorous light ochreous-fuscous; without markings: cilia darker ochreous-fuscous. Hindwings with termen rounded; light fuscous, becoming whitish-fuscous on basal half; a fine fuscous line along termen; cilia as in forewings, but becoming whitish around anal angle.

Mackay and Brisbane, Q.; two specimens, in November.

PYRAUSTA HYALISTIS, n.sp.

♂. 25 mm. Head, palpi, antennæ, legs and thorax ochreous-fuscous, palpi paler beneath, posterior legs ochreous-whitish. Abdomen greyish. Forewings elongate, rather strongly dilated; ochreous-fuscous; first line finely dentate throughout, nearly straight; second strongly dentate throughout, and with a deep sinuation below middle; a triangular, somewhat hyaline spot in cell in middle, edged on sides with fuscous; two elongate contiguous similar spots below costa at ¾, preceding beginning of second line, groundcolour below much lighter; three or four fuscous dots on apical portion of costa; a row of fine fuscous dots along termen: cilia ochreous, with a fuscous subbasal line. Hindwings with termen rounded; pale yellowish; second line as in forewings; a faint fuscous discal dot; a suffused light fuscous band along termen, narrowed towards anal angle; terminal dots and cilia as in forewings.

Sale, Melbourne, Vic.; three specimens, in November.

PHLYCTENODES OCHROMORPHA, n.sp.

♀. 20 mm. Head, palpi and antennæ fuscous, palpi beneath whitish. Thorax and abdomen pale ochreous. Legs ochreous-whitish, anterior pair infuscated. Forewings elongate, moderately dilated; termen oblique, hardly rounded; pale ochreous, markings fuscous; first line irregular, divided into spots; second dentate throughout, strongly curved inwards below middle; a large spot on posterior end of cell; a row of fine dots along termen: cilia ochreous tinged with fuscous. Hindwings with termen rounded; pale greyish-ochreous, thinly scaled; cilia as in forewings.

Derby, W.A.; one specimen, in November.

TORTRICINA.

TORTRICIDÆ.

Tortrix metallocosma, n.sp.

♂. 16 mm. Head, antennæ and thorax dark reddish-fuscous. Palpi and legs ochreous-whitish, posterior legs fuscous. Forewings elongate, costa slightly arched, termen gently rounded, oblique; deep reddish, darker on basal half; three pairs of purplish metallic transverse waved lines, first pair curved outwards, from before middle of costa to middle of inner margin, where they meet; second pair similar, from ⅔ of costa to just before anal angle; third pair similar, from costa before apex to about ⅓ of termen; a row of blackish spots from base to along costa and continued around apex, along termen and ending on anal angle, interspaces more or less filled in with ochreous, costal spots more quadrate and less defined: cilia fuscous. Hindwings with termen rounded; bright orange, with a few fuscous scales towards apex; cilia fuscous.

Not near any other known Australian species, but having the facies of one of the genus *Eupselia (Plutellidæ).*

Cooktown, Q.; one specimen, in October.

TINEINA.

PLUTELLIDÆ.

Eupselia philomorpha, n.sp.

♀. 16 mm. Head yellow. Thorax, antennæ, legs and abdomen dark purplish-fuscous, posterior tibiæ and tarsi orange. Palpi yellow. Forewings elongate, moderate, costa hardly arched, termen rounded, oblique; dark purplish-fuscous, with ochreous markings; a large somewhat cuneiform spot lying on inner margin at base, extending to beyond $\frac{1}{3}$, separated from costa by a thick streak of groundcolour; a large elongate-quadrate patch on middle of costa, extending more than half across wing, posterior edge faintly curved inwards; a small subcostal spot before apex: three roundish black spots on lower $\frac{2}{3}$ of termen, anterior edges yellowish, posterior metallic purple: cilia dark fuscous. Hindwings with termen rounded; bright orange; some black scales along base; cilia fuscous.

Stawell, Vic., one specimen, in November.

A beautiful species, perhaps nearest *holoxantha*, Lower, but the large ochreous spots of forewings are very different from that or any other known to me.

STUDIES IN AUSTRALIAN ENTOMOLOGY.

No. XI.

Description of a New Ground Beetle from Victoria.

By Thomas G. Sloane.

Morphnos besti, n.sp.

Elliptical-oval, robust, convex, apterous; prothorax cordate with rectangular basal angles. Black.

Head large (7 × 8 mm.); front strongly biimpressed; genæ swollen below eyes. Mandibles prominent, decussating. Prothorax cordiform (7·2 × 10 mm.); sides lightly sinuate towards base; anterior margin lightly and widely emarginate in middle; anterior angles very near head, obtuse, not advanced; base widely emarginate, truncate on each side; basal angles rectangular, *not produced backwards*: lateral border wide, reflexed, continuing on to base at each side; lateral channel wide, curving widely on to base at each basal angle; posterior marginal setigerous puncture distinct, placed on border at basal angle (outside lateral channel); median line distinct. Elytra wide, oval (17 × 11·5 mm.); sides roundly narrowed to humeral angles, these obtuse, not marked; seven inner striæ deep, sulciform, subcrenulate; interstices convex, third usually unipunctate near apex; eighth well developed on sides, obsolete on basal sixth, obliterate on apical fourth; ninth (forming bottom of the wide lateral channel) seriate-punctate; lateral margin wide, carinate and reflexed on basal third, thickened with rounded edge between basal third and apical sinuosity; marginal plica distinct but not interrupting lateral margin near apex. Posterior trochanters in ♂ stout, wide near apex, the apex itself forming a short stout cylindrical curved hook; in ♀ short, stout; apex obtuse, not furnished with a hook. Length 29-31, breadth 11·5 mm.

Hab.—Grampian Mountains, Victoria (Messrs. D. Best and C. French, junr.; in October, under logs in damp places at Hall's Gap, near Stawell, Vic.).

Agreeing with *M. flindersi*, White, in all features of structural importance, but very distinct by its form more robust and convex; prothorax shorter, more cordate, more convex, the base truncate on each side with rectangular angles (the basal angles not produced backwards and acutely prominent), a large wide concave depression near each basal angle (the lateral basal part of the prothorax not depressed and explanate), the lateral border and channel continued past the basal angle for a little distance on to the base; elytra wider, more oval, more convex, sides narrowed to the rounded humeral angles, base not nearly so much wider than the base of the prothorax, reflexed carina of the lateral border extending further backwards from the shoulders, margin hardly interrupted behind it, and much wider than in *M. flindersi*, lateral channel much wider and not interrupted at the posterior extremity of the reflexed part of the border, posterior trochanters in the ♂ stouter, shorter, with stouter and shorter apical hook.

THE DETERIORATION OF RAW AND REFINED SUGAR CRYSTALS IN BULK.

By R. Greig Smith, M.Sc., Macleay Bacteriologist to the Society.

Through the kindness of Messrs. Steel and Walton, of the Colonial Sugar Refining Co., I was furnished with several samples of cane sugar which were undergoing a slow process of inversion, that is, the cane sugar was being altered into invert sugar The samples included various grades of the best class of refined sugars, and to all appearance consisted entirely of saccharose.

The first sample was taken from a laboratory sample bottle which had been opened many times to test the progress of the inversion. It was a small-grained moist refined sugar, and during storage in a loosely corked bottle, had shown the following percentages of reducing sugar. For the figures I am indebted to Mr. Walton.

Date.	Storage.	Reducing Sugar %.
12-3-01	0 days	0·21
19-4-01	38 days	0·61
25-5-01	74 days	0·83
25-6-01	105 days	1·01

The bacteriological examination of two portions gave the following relative numbers of microscopic fungi.

	i.		ii.	
Bac. levaniformans, normal type ...	4	5	2	7
,, derived type ...	1		5	
Inert bacteria	4		—	
Streptothrix sp.	7		4	
Aspergillus glaucus	5		6	
	21		17	

With larger quantities of the sample, greater numbers of colonies were obtained, but they did not differ in any great degree, nor did they include any other active organism than in the tests tabulated above. The method employed for separating the bacteria was the ordinary one of infecting molten agar with a few crystals of the sugar and pouring the agar into a Petri dish after the sugar had dissolved. From several plates thus prepared, one containing from 15 to 30 colonies was taken, and every colony was infected into nutrient agar and into saccharose peptone, prepared as described in a preceding paper (*antea*, p. 592). When in about three or four days, the saccharose peptone in some of the tubes had become white and opaque, all the saccharose peptone cultures were tested for gum by precipitation with alcohol, and for reducing sugar with Fehling's solution. The active bacteria were thus indicated, and the further identification of the bacteria was made from the agar culture.

With regard to the bacillus, both were types of the organism already described as the gum bacillus, *Bac. levaniformans*, which has been shown to rapidly cause the inversion of saccharose in solution. The inert bacteria had no action upon sugar, and were not investigated further. The streptothrix slowly inverted saccharose. The aspergillus was a race of *Aspergillus glaucus*, which readily formed aerial ascospores. The inverting action of *Aspergillus* is well known.

The second sample was a soft-grained refined but not quite white sugar. The colonies that developed on the infected agar plates were found to consist of the gum bacillus alone. One portion contained the derived type, another contained a majority of the derived type, with a few colonies of the normal bacillus.

The third sample was similar to the second, but of a slightly darker shade. Compared with the second sample, it was nearly sterile, but the few colonies that developed consisted of the derived and the normal type of *Bac. levaniformans* in the ratio of about 1 to 6.

A fourth sample of white crystalline refined sugar contained the normal bacillus; only one colony of the derived type was obtained from one of the portions.

A sample of raw sugar solution of the consistency and appearance of thin molasses was, when received, slowly fermenting, that is to say, bubbles of gas were being given off. A film of the solution showed the presence of a yeast, and the gum bacillus of the normal type was isolated by plate culture.

A moist raw sugar had been tested in the laboratory of the Colonial Sugar Refining Co., and had shown the following percentages of reducing sugar:—

10-5-01	1·43
25-5-01	2·90
25-6-01	4·46

From an agar plate infected with the sample, there were obtained 30 colonies of the normal type, 3 of the derived type, and 1 inert bacterium.

A soft yellow refined sugar which contained 2·5 % reducing sugar, and which had undergone no change during a storage period of 3½ months, contained, for every 12 inert bacteria, 2 of the normal and 1 of the derived type.

Another similar sugar which contained the same percentage of reducing sugar, and which had shown no further inversion in three months, contained, for every 30 inert bacteria, 15 bacilli of normal type.

A raw sugar which had been damaged by water in November, 1895, showed a very heavy inversion. The water content, after the damage had been done, was 6·97 %. The analyses which were made in the Sugar Company's laboratory from time to time, are as follows.

Date of Analysis.	Reducing Sugar %.	
Nov. 22, 1895	0·9	
,, 25, ,,	3·1	
,, 27, ,,	4·3	
Dec. 11, ,,	9·6	
,, 24, ,,	11·6	
Feb. 20, 1896	15·6	
Nov. 1, 1898	20·8	
June 20, 1901	26·3	
Nov. 13, 1901	32·7	dextrose 18·9 levulose 13·8

The bacteriological examination of this interesting sample showed that it contained the bacilli of the normal type in practically pure culture, there being one inert bacterium to every ninety-nine active bacilli.

It is apparent from the bacteriological examination of these samples that the inversion is the direct result of the growth of the bacillus which I have described in the previous paper and to which the name of *Bac. levaniformans* has been given. Indeed it was from these samples that the numerous races of the bacillus were obtained. The organism has been already shown to be capable of growing in solutions of cane sugar containing but a trace of nitrogenous food, as for example in solutions containing one-thousandth of a per cent. of peptone. When growing in this poor medium it alters the sugar so much as to produce a visible formation of gum in a few days. In view of this faculty of growing in poor media and of the fact that an inversion of sugar accompanies the growth, there can be no doubt that it is alone responsible for the inversion of the crystals in bulk, and that the chief condition for its growth is a more or less moist state of the sugar and a warm temperature.

It has been already noted that the relative formation of gum levan is less and the inversion of sugar greater in poor nitrogenous than in more nitrogenous solutions. In refined sugar crystals the amount of nitrogenous matter is infinitesimal, and it may be that the gum-forming faculty is entirely in abeyance, since no gum is found in such sugars.*

But although this hypothesis may partially explain the absence of gum in bulk sugar, there is another property of the gum cultures that must be taken into account. During the prolonged cultivation of the bacillus, the solutions of sugar which during the height of the fermentation are white and opaque, gradually, as time goes on, become more and more translucent. The gum precipitable by alcohol becomes less, and at the same time the invert sugar increases. This is proved by the analysis of a 50 days' culture which in the following table is compared with the analysis during the height of the fermentation. As in the previous paper, the figures are expressed in parts (grms.) from 100 of the original saccharose.

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* For example, the sample which had heavily inverted and which contained 26·3 % reducing sugar had only 0·19 % of gum and insoluble organic matter precipitable by alcohol.

GUM AND REDUCING SUGARS IN OLD CULTURES.

	12 days.		50 days.
Mixed reducing sugars ...	62	..	71
Crude gum	31	.	22

The slow hydrolysis of the gum is probably the result of the action of the acids secreted by the organism and contained in the culture fluid. In a previous paper (*antea*, p.595) the solvent action of the acid upon the gum was noted, and it was seen that when the acidity of the culture was not neutralised the gum was incompletely precipitated, and during the process of eliminating the alcohol it was partly (or entirely) converted into reducing sugar. But to place the hydrolytic action of the acid, which is chiefly lactic, beyond doubt, the following test was made. A fragment of pure gum was dissolved in water and a portion of the solution tested with Fehling's solution. There was no reduction of the copper hydrate. Another portion was boiled for 30 seconds with an equal volume of normal lactic acid, neutralised and tested, when a copious precipitate of the red suboxide was obtained. This test places the action of the acid beyond doubt.

The action was also tested quantitatively. The acidity of the 50 days' culture was first tested and found to be equal to 0·9 c.c. normal lactic acid in every 100 c.c. of culture fluid. Then 1·388 grms. of gum, free from reducing sugars and dried at 100° C. for several days, were dissolved in 100 c.c. of water to which 0·9 c.c. normal lactic acid was added. The solution was heated at 80° C. for three hours, and after being cooled was made up to volume. The sugar was estimated and found to be equal to 1·21 grms. of reducing sugar. Assuming the gum to have been 96 % pure and to have the formula C H O, the determination showed that

80% was converted into sugar by heating for three hours at 80° C. with an amount of lactic acid equal to that found in the cultures.

The deterioration of Hawaiian raw cane sugar was investigated by Shorey[*] about three years ago. In the paper he mentions that one of the reasons put forward to account for the inversion of the sugar is a fermentation caused by bacteria, prominent among which are those producing lactic and butyric acids. At another place he writes:—

"It is generally accepted that the butyric ferments are without the power of inverting cane sugar, while the lactic ferments sometimes seem to have this power. It seemed to me, however, very unlikely that the inversion could be brought about by bacteria. The sugar was quite dry, the crystals separate and distinct, and in appearance was like so much air-dried sand. Even in December, when the deterioration had reached 4·0°, although the sugar was moist, each crystal was still separate and distinct, being simply coated with a thin syrupy film. Bacteria can only reach development in a liquid or semi-liquid continuous medium, and sugar, so long as it continued so dry that the crystals remained distinct and separated by air spaces, would necessarily prove a medium ill-adapted for the growth of such bacteria as produce lactic or butyric acid. Moreover, all the sugars examined showed as the result of deterioration a very small amount of acid and a comparatively large amount of invert sugar. Now if lactic acid ferments were the invertive agents, the processes of inversion and production of acid would undoubtedly go on together or so closely that they would seem simultaneous. I was led to conclude then that the inversion was not produced by lactic or butyric ferments, but by some other agent."

Shorey did not search for bacteria, but he discovered the mycelia of *Penicillium glaucum* distributed among the crystals, and concluded that this ubiquitous mould was the active inverting agent in the particular samples.

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[*] Shorey, Journ. Soc. Chem. Industry, xvii., 555.

With regard to the inverting action of the ordinary lactic bacteria, it may be said that any invertive power which they have must result from the hydrolytic activity of lactic acid, for according to Reynolds Green, and also Lafar, there are but few bacteria known which secrete invertase, and these do not include the lactic bacteria. Lactic acid undoubtedly causes the inversion of saccharose, and there is no reason why a comparatively small amount of acid should not in an indefinite time produce a comparatively large inversion. I have quoted Shorey chiefly to show how one might be led astray by *a priori* reasoning, for his remarks about the Hawaiian sugars would apply equally to these Australian samples. *Bacillus levaniformans* is an organism that plays many parts. It is at once a lactic and a butyric acid ferment, and it is capable of inverting a comparatively large amount of sugar, probably through the action of invertase, for the heavy inversion points to the presence of this enzyme.* Furthermore, it cannot be doubted that its spore-forming faculty and its gum capsule enable it to survive and vegetate under conditions which would be adverse to most other forms of bacterial life.

And now a word about the distribution of the organism. The habitat of *Bac. levaniformans* is not restricted to one set of mills and one refinery, but it is widely distributed. It may be the cause of the deterioration of the Hawaiian sugars, and it certainly occurs in the Australian mills. I have examined a set of samples of raw and refined sugars from various parts of the world. These I received from the Colonial Sugar Refining Co., with the information that the sugars had been kept in tightly stoppered bottles and had been opened only to send me smaller samples. The result of the investigation was as follows. The qualification—few, many, or very many—indicates in a rough manner the number of colonies obtained from about 1 grm. of sample.

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* A sterile culture solution with 0·08 % lactic acid (= the acidity of a culture) was placed in the incubator for four days at 37°. At the end of this time 2·8 % reducing sugars were found. As the acidity in a culture of the bacillus does not reach 0·08 % for 24 hours, we should allow a day and compare the four days' inversion by acid with a five days' inversion by bacteria. The great difference in the amount of reducing sugars, between 2·8 (a four days' acid inversion) and 50 (the reducing sugars in a five days' culture) shows that a strong inverting agent is secreted by the bacilli.

	Source and quality of sugars.	*Bac. levaniformans.*
1.	Demerara, ordinary pale	absent.
2.	„ ordinary yellow	few present.
3.	Mauritius, ordinary white	many present.
4.	Peruvian, good quality crystal	very many present.
5.	Egyptian, good quality raw sugar	many present.
6.	„ „ „ „ „	many present.
7.	Java, ordinary good	very many present.
8.	„ stroops, very low moist raw sugar	many present.
9.	German, low beet sugar	very many present.
10.	„ „ „ „	many present.
11.	„ granulated refined	sterile.
12.	Russian, refined beet	few present.
13.	French „ „	many present.
14.	Fiji, raw crystals	very many present.

Since the organism is contained in sugars from such distant places, it is safe to say that its distribution is universal.

Perhaps it would not be out of place to indicate how the sugar technicist should test for the organism. In a litre of tap water there are dissolved 100 grms. saccharose, 1 grm. peptone, 5 grms. potassium chloride, and 2 grms. common sodium phosphate. The solution is filtered, if necessary, and about 100 c.c. are filled into clear glass bottles, which are plugged with cotton wool. The bottles are placed in a steamer (a potato steamer would do) and steamed for twenty minutes on three successive days. They are then kept as near 37° C. as possible for 10-12 hours and again steamed. This is followed by keeping at 37° for two days, and those bottles which remain bright are sterile. All this procedure is necessary, because of the possible presence of *Bac. levaniformans* in the sugar. Into the sterile solutions about two grms. of the suspected sample are introduced by means of a small spoon or spatula, which has just cooled after having been sterilised by heating in a flame. The infected bottles are maintained at 37°. In from two to four days the presence of *Bac. levaniformans* is shown by the fluid becoming milky. A turbidity of the solution must not be confounded with the opaque milkiness which is characteristic of *levaniformans*. At the same time it must be borne in mind that some races produce but a faint opalescence that might easily be mistaken for a turbidity of the solution. In all cases it is advisable to extract a small loop or a tiny drop by means of a sterile looped platinum wire, or a sterile dropping pipette, and infect a fresh bottle. In from 5 to 7 days, when the formation of levan is at a maximum, the second culture could be tested for reducing sugars and also for levan by precipitation with alcohol and subsequent solution in water.

Of course, the bacteriologist would also test the sugar straight away by preparing plates from saccharose-agar or even ordinary nutrient agar, infected with about 1 grm. of the sample. Any suspicious colony that developed would be picked out, infected into the saccharose fluid medium, and from this, as a starting point, he would proceed to identify the organism. The primary plate method is much more satisfactory than fluid cultures, because foreign organisms, in some cases, appear to hinder the development of *Bac. levaniformans*.

So far as the economic importance is concerned, it is, perhaps, impossible to estimate the loss entailed directly or indirectly through the activity of the organism. In many cases raw sugar has been known to have deteriorated during storage at the mill, in transit to and in storage at the refinery. At one refinery in Sydney the loss through inversion during the storage of the raw sugar has at times been considerable. During the last three years, however, the Colonial Sugar Refining Company, suspecting the loss to have been due to the activity of micro-organisms, have altered their methods of manufacture, and the sugar is now less subject to change. In three years the average loss through deterioration has been reduced from 0·5 to 0·1 on the whole stocks. This means that the loss of pure sugar on an annual stock of say 50,000 tons, which three years ago was 250 tons, has now been reduced to 50 tons. And as the sugar destroyed is transformed into objectionable substances, the removal of which in the process of refining entails a further loss of a similar quantity of pure sugar, there is thus a double loss, the money value of which was about £5,000 three years ago, while now it is £1,000. I have these figures from Mr. T. U. Walton, the chief chemist to the Colonial Sugar Refining Company. The degradation might have been caused by many agents, but one is probably justified in ascribing over 95 % of it to the action of *Bac. levaniformans.*

THE ACID FERMENTATION OF RAW SUGAR CRYSTALS.

By R. Greig Smith, M.Sc., Macleay Bacteriologist to the Society.

During the storage of raw sugar crystals in bags, an acid fermentation occasionally sets in. The sugar becomes decidedly warm to the hand, and a strongly acid odour, suggestive of a mixture of acetic and butyric acids, is evolved.

Two samples of sugar undergoing this fermentation were investigated for microscopic fungi after the manner already described in the preceding paper. The first sample, which had an acidity to phenolphthalein equivalent to 0·36 % lactic acid, contained both kinds of *Bac. levaniformans*, the gum bacillus, and no other bacteria, yeasts or moulds. The second sample had an acidity equivalent to 0·31 % lactic acid, and contained the derived type of *Bac. levaniformans* in pure culture.

From the presence of this bacillus in the sugar, it cannot be doubted that it is alone responsible for the acid fermentation. It has been already shown that the acids secreted during the growth of the organism consist of capric, carbonic, lactic, butyric, acetic and formic. The odour of the sugar is suggestive of butyric and acetic acids, but formic acid might easily be contained among the volatile acids. The latter is readily detectable by mercuric chloride, and in order to test if it were present, about 25 grms. of sugar were acidified with dilute sulphuric acid and distilled. On heating the distillate with mercuric chloride, a white precipitate of calomel was obtained. This test is sufficient to indicate formic acid, and the presence of this acid, which is one of the byproducts of the gum bacillus, confirms the fact that this organism is the cause of the acid fermentation.

NOTES ON THE BOTANY OF THE INTERIOR OF NEW SOUTH WALES.

By R. H. Cambage.

(Plates xxxi.-xxxiii.)

Part V.—From Parkes to Marsden.

In following the road from Parkes to Forbes, which is southerly about 20 miles, the following species were noticed:—*Callitris robusta* (White or Cypress Pine), *Casuarina Luehmanni* (Bull Oak), *Eremophila Mitchelli* (Budtha or Sandalwood), *Myoporum deserti* (Dogwood), *Eucalyptus melliodora* (Yellow Box), *E. Woollsiana* (Box), *E. hemiphloia* var. *albens* (White Box), *E. conica* (Apple Box), *E. rostrata* (River Red Gum) on Goobang Creek, and a few trees of the following three species, *Acacia Oswaldi*, *A. homalophylla* (Yarran), and *Pittosporum phillyrœoides*. One plant was found of an Acacia which resembles *A. acinacea*, Lindl., but in the absence of flowers and pods it has not been definitely identified.

On some ridges about three miles north-westerly from Parkes *Eucalyptus sideroxylon* (Ironbark), and *E. affinis*, Deane and Maiden (White Ironbark) may be found.

On reaching the Lachlan River at Forbes, *Casuarina Cunninghamiana*, Miq., (River Oak) is seen for the first time. This species invariably follows the banks of streams, and in deep valleys its dark green foliage is conspicuous for many miles, thereby serving to indicate to an observer in an elevated position the courses of rivers and large creeks. Most of our western rivers have two reliable species following along the water's edge. These are *C. Cunninghamiana* and *Eucalyptus rostrata*, their difference in allocation being that the former takes possession of the higher portions of the stream, and the latter of the lower, but for very many miles they overlap. On the Lachlan River both species are represented from about 30 miles below Forbes up to about 30 miles above Cowra; thence the Oaks continue upwards and the Gums downwards. I have not been able to hear of any River Oak below Condobolin; the trees, even in the Forbes district, become fewer as the lower country is reached. The fact of their ceasing altogether is the more remarkable when it is remembered that every year there must be an enormous quantity of seed carried down by the stream. Probably the soil along the lower parts of the river is more of a salty nature than that at higher levels, as I have seen the water from mining shafts in the low country of the Lachlan district too salt to be used in the engine boilers employed at the batteries. It is also known that in drought times, at least in the Darling, the water becomes brackish and even salty from the inflow of brine springs along the bank of the river, and this may be the chief cause in preventing the growth of the Oak trees. The seeds germinate very readily in damp places, and in the cracks of an old log lying in the river I once counted 35 young trees varying from one to ten feet high. They would probably never mature, as the expanding roots would split the log, and the several parts would then be likely to be carried away by floods.

C. Cunninghamiana is usually a diœcious species, and on the upper parts of the Lachlan in the month of April, when standing on the hillsides overlooking the river, the trees bearing male flowers can be readily distinguished by their colour from those bearing female flowers. The same features may be noticed among the Hawkesbury valleys in July with one of the Forest Oaks, *C. suberosa*.

All our Casuarinas with the exception of *C. Cambagei* (Belah) have the common name of Oak, and yet they bear no outward resemblance to the Quercus family or well-known English Oak, differing both in bark and foliage. Still there is a tradition that the early English arrivals noticed a similarity in the wood through both species having medullary rays, and this feature suggested to them the name of Oak for the Australian trees. The Belah, which has very inconspicuous rays, seems to have kept a distinct name, although it might, through its foliage, easily be confused with other Casuarinas.

C. Cunninghamiana is, so far as I have been able to observe, purely a fresh water tree, and must not be confused with the Swamp Oak, *C. glauca*, often found near salt water along the coast. The former, in addition to growing near fresh water, is generally an indication of good drinking water, while the latter, though usually on salt flats, will sometimes follow up fresh water creeks, but in such cases it often happens that the stream is sluggish and the water brackish. A remarkable instance of how trees are sometimes restricted to their proper conditions occurs at the head of Burrill Lake near Ulladulla. This inlet is chiefly supplied with ocean water, and in many places on the flats around its margin there are trees of *C. glauca* (Swamp Oak), which extend westward practically as far as the salt water goes, a distance of about four or five miles. At this point the lake assumes the form of a salt water river, which again narrows at a slightly higher level into a fresh water creek. Oak trees may be seen continuing up the fresh water stream, known as Woodstock Creek, for a distance of scarcely half a mile, but curiously these are not *C. glauca* at all, but *C. Cunninghamiana*, which with their finer branchlets and smaller fruits can easily be distinguished from the former species. Above the point where the Oaks cease the creek soon becomes smaller, and is scarcely what is considered large enough to boast of Oak trees, while below the River Oaks the water is salt. The nearest point to this at which *C. Cunninghamiana* may be found is on the Clyde River, about a dozen miles westerly across mountains exceeding 1000 feet high. The formation immediately surrounding the fresh water Oaks is plutonic, but the country drained by the head waters of the creek is Permo-Carboniferous. It has been suggested to me that possibly these few Oak trees are the surviving descendants of a once more numerous assemblage in prehistoric times. It is believed that there has been an alteration in the relative levels of the land

and sea on the east coast during recent geological times; and that the coast line formerly extended as far to the east as the edge of the continental shelf (the present 100 fathom line).* In this case the land around Burrill was formerly higher, and the salt water would have been kept back at least some miles to the eastward. Under these conditions the present bed of Burrill would be occupied as a small fresh water river probably lined on both sides with River Oaks. As the alteration of level progressed the salt water would be likely to encroach and destroy all the fresh water Oaks except the few under discussion; and had the alteration continued longer even all trace of these might have disappeared. At the same time, too, the altered conditions would be likely to induce the westerly extension of the salt water Swamp Oak to its present limits.

There appears to be geological evidence to support this view, and I have collected fossils near the mouth of Burrill, at present water level, and similar ones again on the top of the Pigeon House, 2360 feet higher, and about a dozen miles to the westward, which prove the formation in both cases to be the same, viz., Permo-Carboniferous.

Altogether the case presents some interesting features, and is one in which the study of the geological changes might be assisted by a knowledge of botany (Plate xxxiii.).

C. Cunninghamiana is the common Oak tree found on the upper parts of most of the New South Wales rivers, and although it follows up the large creeks in their ramifications among the mountains it never leaves the vicinity of the stream, and is therefore never found on the hillsides among the Forest Oaks.

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* See Prof. David's "Anniversary Address" to the Royal Society of New South Wales, May, 1896. Journ. and Proc. R. Soc. N.S.W., Vol. xxx., pp. 43, 48, 69.

Also a paper "On the Occurrence of a Submerged Forest with Remains of the Dugong at Shea's Creek, near Sydney." By R. Etheridge, Junr., Prof. David, and J. W. Grimshaw, *Op. cit.* pp. 160, 176, 178.

In following the Lachlan River from Forbes to Condobolin, which is westerly about 60 miles, the species chiefly seen are those which belong to river country. *Eucalyptus rostrata* and *E. melliodora* continue all the way. *E. conica* is plentiful. *E. Woollsiana* and *E. tereticornis* occur at intervals, while *E. tereticornis* var. *dealbata* is only seen where the hills come near the river as at Jemalong. This is the spot where it may be seen growing about 20 yards from the River Red Gum *(E. rostrata)*, but showing no gradation towards that species (*vide* Part ii., p.713). *E. populifolia* occurs some miles below Forbes, and this spot marks its most easterly limit on the Lachlan. *E. largiflorens* is met with a few miles above Condobolin, which denotes its most easterly point on the Lachlan. In travelling across from Forbes past Lake Cowal to the Murrumbidgee above Narrandera, this species was not seen again, but it extends south-westerly into Victoria and South Australia as well as northwards along the Darling and its tributaries, though seldom leaving the river or damp flat country. *E. sideroxylon* is never found in river country, consequently it is not noticed except on a ridge just north of Condobolin.

The Casuarinas noted were:—*C. Luehmanni*, *C. Cunninghamiana* and *C. Cambagei*. Other trees passed were:—*Callitris robusta*, *Heterodendron oleæfolium* (Rosewood), *Hakea leucoptera* (Needlewood), *Eremophila Mitchelli*, and *Pittosporum phillyræoides*, the last named being pointed out to me by several as the tree known by the aborigines as Berrigan or Barrigan. Its drooping foliage, always attractive, is beautified in the autumn by a considerable quantity of yellow fruit. Although this species may be found extending over a very large area in this and adjoining States, it always appeared to me to be scarce, and was generally noticed as a solitary tree. The reason of this is partly owing to its popularity as a fodder plant; and without conservation its extermination seems inevitable.

The Acacias are represented by *A. Oswaldi* (often called Dead Finish), *A. pendula* (Boree or Myall), *A. homalophylla*, *A. stenophylla*, *A. salicina* (Cooba), and the Silver Wattle *A. dealbata*.

Some trees of Cooba were noticed with a diameter of two feet. Only a few trees of *A. dealbata* were seen, but they were large and had the same silvery appearance that is so constant a feature on the highlands. In coming from Bourke these were the first of typical *A. dealbata* noticed. They were on the south side of the river at about 17 miles below Forbes, and were flowering in the first week in August, 1899. I have never seen any others within fifty miles of this spot.

From Forbes to Pinnacle Mines, a distance of about 20 miles southerly, the country is level, and only those species were seen which belong to the flat country. *Casuarina Cunninghamiana* is found only on the Lachlan close to Forbes, but *C. Luehmanni* and *C. Cambagei* are noticed at intervals along the roadside. *Myoporum deserti*, *Callitris robusta*, *Eremophila Mitchelli*, *Heterodendron oleæfolium* and *Geijera parviflora* (Wilga) are also distributed throughout this stretch of country.

The Acacias noticed were:—*A. dealbata* (green variety), *A. homalophylla*, *A. Oswaldi* and *A. pendula* which is here and to the southward more generally known as Boree than Myall, the latter name, as well as Yarran, being often applied to *A. homalophylla*.

Eucalyptus rostrata is to be seen near the Lachlan and on many of the swamps to the southward. *E. melliodora*, *E. Woollsiana* and *E. conica* are common along this road, while *E. hemiphloia* var. *albens* is seen only when nearing the Pinnacle Mine on a slight rise.

About three miles south-easterly from the mine is a very conspicuous hill known as the Pinnacle Mountain, which may be distinctly seen from the top of Canoblas near Orange on a clear day. It appears to be an outlier of the Devonian period, though in the course of a walk across it I found no fossils to prove this. On the northern side it ends abruptly, forming a few small sandstone cliffs which look somewhat imposing when viewed from the surrounding plains. On approaching it from the western side the following trees and shrubs were seen:—*Casuarina Luehmanni*, quantity), *Celastrus Cunninghamii* (a shrub), *Fusanus acuminatus* (Quandong), *Cassia eremophila*, *Eucalyptus melliodora*, *E. Woollsiana*, *Acacia spectabilis*, *A. hakeoides* and *A. Oswaldi*. On ascending the Mount, *A. amblygona*, *A. doratoxylon* (Currawong), *Helichrysum* sp., *Caladenia cœrulea*, *Eucalyptus tereticornis* var. *dealbata* (Mountain Gum), *Callitris calcarata* (Mountain Pine), and *Brachyloma daphnoides*, Benth., were noticed. The strong sweet-scented flowers of this last.named little shrub were plentiful the first week in September. Towards the north side are *Tecoma australis* (Bignonia), *Beyeria viscosa*, *Phyllanthus thymoides*, Sieb., and *Exocarpus cupressiformis* (Native Cherry). Other plants distributed about the top are *Grevillea floribunda*, *Calythrix tetragona*, Labill., *Dillwynia juniperina*, Sieb., *Zieria aspalathoides*, A. Cunn., *Casuarina quadrivalvis* (She Oak), and *Morchella conica*, Pers. This latter and other somewhat similar species of Fungi were known to the aborigines by the name of Merl. On the eastern side is *Eucalyptus hemiphloia* var. *albens*, also extending round to the south, where it is associated with *E. sideroxylon*. Wherever these two trees grow together, a third tree, which looks very much like a hybrid between them, may be expected. This is *E. affinis*, often called White Ironbark and sometimes Black Box. It was found here in company with the above trees.

This species has been under my notice for about ten years. It was first seen at Grenfell, and was then discussed with several bushmen, who all agreed that in outward appearance it seemed to show quite as much affinity to *E. hemiphloia* var. *albens* as to *E. sideroxylon*, but in working the timber they found the wood had more resemblance to the Ironbark than the Box. This testimony has since been supported by others. Outwardly it is in its lower part, where the bark is fairly rough, that the likeness to the Ironbark is seen; while the upper part, having a much smoother bark, suggests a relationship to the Box. The usual colour of the bark is brown, and by this alone it may generally be separated on sight from the other two species. When the bark is first removed it is found to have a greenish-yellow sap similar to the Ironbark, while that of the Box is white. The timber is tougher than that of the Ironbark and not so dry, and is considered by many to be better for wheelwright's work than either the Ironbark or the Box. Its colour is lighter than that of the former and darker than that of the latter. The trees are never plentiful, and in a forest of *E. sideroxylon* the proportion would roughly be about 15 or 20 of the latter to one of *E. affinis*, but the proportion varies in different forests. In the western districts *E. sideroxylon* is generally found on ridges, while *E. hemiphloia* var. *albens* takes the sides and more open country as well, though the two species are often found growing side by side, and both flower about the months of April, May and June. As a general rule I have noticed that *E. affinis* is found growing close to *E. sideroxylon*, and is seldom out in the open with the Box, thus showing that it has a greater similarity, as regards habitat, to the former species. In its buds, fruits, bark and timber, it appears to be just about midway between the two species, and shows very little variation. In view of all its characteristics, I am strongly inclined to the opinion that the species is one of the newest Eucalypts, and has been evolved in some way from *E. sideroxylon*. Circumstantial evidence alone seems to point to the conclusion that the species is the result of hybridization, but it is of course quite impossible to speak with any certainty on the matter, for even if such were the case it would be almost impracticable to secure proof.

Messrs. Deane and Maiden have recently described a questionable hybrid, long known as a separate tree growing near Cabramatta, and named it *E. Boormani* (these Proceedings, 1901, xxvi., 339). This tree, though somewhat similar, would not generally be confused with *E. affinis*, as it shows such a strong affinity to *E. siderophloia* in addition to *E. hemiphloia*. The Ironbark-Box of Concord is also easily separated, as it shows an undoubted affinity to *E. paniculata*.

In most respects *E, affinis* is indistinguishable from the Ironbark-Box of Nymagee (mentioned in previous papers) except by the buds and fruits. As regards bark and timber, they appear to be identical. The fruits of the Nymagee tree are much smaller, and if these trees are hybrids between *E. sideroxylon* and *E. Woollsiana*, the difference in size of fruits would be accounted for, as those of the latter are generally less than half the size of *E. hemiphloia* var. *albens*.

If *E. affinis* were originally produced by hybridization, it seems to be sufficiently well established now to propagate itself without assistance from other flowers, for on one occasion only I found a single tree of it when driving along a track through a forest of *E. sideroxylon* near Reefton in the Temora district. I had no time to examine either side of the road, and no trees of *E. hemiphloia* var. *albens* were in sight, though I afterwards found that they were plentiful on a ridge a few miles to the eastward, but cannot state the exact distance to the nearest tree.

E. affinis may be found on ridges near Dubbo, Wellington, Peak Hill, Molong, Parkes, Grenfell and Temora, and, like *E. sideroxylon*, has a decided preference for sedimentary formations.

In giving all the above particulars my object has been to make available any facts I have collected, without trying to prove any theories for or against hybridization. One thing undoubtedly seems evident, which is that the conditions which are favourable to the production of both *E. sideroxylon* and *E. hemiphloia* var. *albens* are also suitable to *E. affinis*.

In regard to the botany of the Pinnacle Mount, one feature noticed was the presence of more species of the coast flora than had been previously seen at any spot in coming from Bourke, representatives of the following genera being found for the first time:—*Brachyloma*, *Phyllanthus*, *Calythrix*, *Dillwynia* and *Zieria*. Some other coast forms found here have been mentioned in previous papers.

From Pinnacle Mountain to Marsden, near Lake Cowal, *via* Blink Bonnie, is about 30 miles south-westerly, being chiefly plain country. The trees and shrubs noticed were as follows:—*Eremophila Mitchelli*, *Heterodendron oleæfolium*, *Callitris robusta*, *Myoporum deserti*, *Pittosporum phillyræoides*, *Geijera parviflora*, *Exocarpus aphylla* (Stiff or Jointy Cherry), *E. cupressiformis*, *Hakea leucoptera* (not plentiful), and *Apophyllum anomalum* (Warrior Bush), which was very scarce.

Casuarina Luehmanni was abundant along the first part of the road; *C. quadrivalvis* was noticed once about half-way on a porphyry hill near Mount Tallabung; and *C. Cambagei* (Belah) was plentiful along the latter half, clumps of its dense dark green foliage standing out conspicuously about the plains, which were otherwise partly silvered over with *Acacia pendula* (Boree).

The Acacias passed were :—*A. homalophylla*, *A. hakeoides*, *A. Oswaldi*, a little of *A. doratoxylon*, *A. decora*, which seems sure to be found where the formation is porphyry, *A. stenophylla* along the banks of the Bland Creek, and miles of *A. pendula*.

In crossing the plains one is impressed with Nature's successful efforts at landscape designing. An open plain of two or three miles extent is entered, which sometimes appears to be hemmed in with Belah and Boree, but in proceeding, openings are found which widen on approach. At first glimpses only are obtained through these spaces, and one is interested in trying to see what is beyond. Gradually there develop other plains, which are all connected, or perhaps should be considered as parts of one great design, artistically divided and decorated by the imposing dark green foliage of the Belah, or the graceful pendulous forms of the Boree.

The Eucalypts found between the Pinnacle and Marsden were *E. hemiphloia*, var. *albens* only at starting, *E. melliodora*, *E. Woollsiana*, *E. tereticornis* var. *dealbata*, *E. rostrata*, and *E. populifolia*, the last-named being only in the latter part and not plentiful. *E. conica* was not seen, although the conditions seemed often favourable, and its southern limit is beyond this point. Still it is not strongly represented south of here. *E. rostrata* was found along the banks of the Bland Creek above Lake Cowal, and also extending back on the flats.

Some specimens of *E. rostrata* were collected with buds having a partially double operculum, which is apparently a feature to be found on most Eucalypts if extended observations be made. It has occurred to me that these outer opercula (except in such cases as that of *E. maculata*, the Spotted Gum of the coast) have been formed from parts of the original bract or thin membrane which in the early stage of inflorescence often encloses each cluster of buds. The covering referred to seems to be inside of the ordinary bracteoles which are usually seen around the buds, and much finer in texture In most cases this covering is soon burst by the growing buds, and the fragments are blown away. A trace, however, is often left at the base, and may sometimes be seen around the pedicels, appearing as several small bracts. But in some cases the point of each bud appears to push forward into this covering bract, thereby causing it to assume a conical shape at each point of contact, and before breaking, it has capped the upper part of each operculum. For a time this cap appears to adhere and grow thicker, but gradually becomes dry and brown, when it readily catches the eye. It is then found to be simply resting on the true operculum, scarcely adhering, and can be removed by a gentle touch. In no case have I found it as long as the operculum proper, generally less than half. I have collected fairly advanced buds of *E. dives*, Schau., wholly enclosed in the bract, but in the handling and drying the structure was in consequence destroyed.

The above remarks are put forth tentatively, as owing to the delicate construction of the buds, and the somewhat uncommon occurrence of this outer operculum, it has been impossible to get a complete series of specimens to explain the phenomenon in a manner that would admit of no doubt, the stage requiring further investigation being the period between when the buds are wholly enclosed, and that at which the outcap begins to change colour.

Early in the year 1900 I was informed by a miner named Kelly who resides in the Grenfell district, that about fifteen years previously he had been a stockman near Lake Cowal, and had seen some trees near there which appeared unusual for the locality. He had also visited Queensland, and had seen there much of what he believed was the same species, which was called Brigalow. He moreover stated that he knew of no other such trees anywhere in the district, and that this clump consisted of one large tree and a number of little ones. Having obtained particulars of the locality, which is about 3½ miles west of

Marsden, I decided to visit the spot if fortune should ever take me in that direction. Later in the same year I had to pass through Marsden, so rode out to the locality indicated. The country consists of plains sparsely timbered with *Acacia pendula*, *Geijera parviflora*, *Hakea leucoptera*, *Casuarina Cambagei*, *Heterodendron oleæfolium*, *Eremophila Mitchelli*, *Eucalyptus Woollsiana*, and *E. populifolia*. When within about half a mile of my destination, an opening in the timber enabled me to see a cluster of shining leaves which had that characteristic sheen so well known by travellers among the Brigalow, and a closer inspection proved that the trees were *Acacia harpophylla*, F.v.M., as surmised. The fact of Brigalow growing in this locality is full of interest, as the species is chiefly a Queensland one, but comes into New South Wales in considerable quantity on the north, though thinning out as it extends southward, and occurring only in patches. The most southern patch, other than that under discussion, with which I am acquainted in the interior, is at Nyngan, and I have travelled considerably over the area included between Dandaloo, Nyngan, Nymagee, Mount Hope and Condobolin without ever having heard of it. The most southern point recorded for Brigalow is Scone, on the eastern watershed (*vide* previous paper, Part iii., p. 209). Marsden, which is almost due west of Sydney, is nearly 120 miles south of Scone (or 230 miles south-west), and 150 miles south of Nyngan.

Instead of finding one large tree surrounded by small ones, I found a cluster ranging from 10 to 30 feet high covering an area of nearly five acres. An enclosure roughly ten chains north and south by five chains east and west would include the whole clump. Most of the trees were very shapely, throwing out branches at a few feet from the ground. An east and west fence passes through the northern half. A search for the original tree resulted in the discovery of an old stump standing about 10 feet high, and two feet in diameter at the ground, though tapering considerably towards the top. This was situated about the centre of the extreme western edge, thus showing that the spread of seed from this tree must have been caused by winds which blew chiefly from the westward, ranging from about N.N.W. to S.S.W. It is not usual for the easterly winds to penetrate so far into the interior, so the distribution is in the direction that might have been expected. How the first seed came there is a question most difficult to answer. It is known that the seeds of the Acacia family were used as food by the aborigines, who would perhaps sometimes carry them a distance for this purpose, notwithstanding their improvident nature. But owing to the very dry stretch of country between the Lachlan and the Bogan in the direction of the Brigalow country, I doubt if there was much communication between the aborigines of these districts, so that the solution of the question may not be here.

It is also known that the seeds of Acacias are enclosed in a very strong testa and preserve their germinating powers for very many years. Seeds are often distributed by birds, and the late Dr. Woolls in his "Lectures on the Vegetable Kingdom," points out that some are also frequently carried in the manes and tails of horses. This is a common occurrence in the western districts, where the seed vessels of many of the grasses and herbs occur as burrs, which have the effect of matting the manes and tails. However, in the present instance it must have been brought some considerable distance, possibly before horses had reached the neighbourhood, and there was a time when this original tree was the only one in the locality, thereby presenting an unusual feature. There is another method of distribution which may often account for trees being found in outlying situations, and that is distribution by wind. Whirlwinds are of common occurrence in the interior, acting quite independently of ordinary wind storms, and along the track which they happen to take they fairly sweep the ground of dust and leaves, &c. The noise made by the rustling of the material when being taken up in the spiral current may be heard a hundred yards off. It is not unusual to see a column of dust extending nearly a quarter of a mile upwards, and visible several miles off. In this way various kinds of seeds may be carried up, but the probability is that in most cases they soon fall. Some, however, when attached to light substances of a suitable shape to be easily blown about, may get carried away in an upper current after being raised by the whirlwind. Many of the prevailing high winds in the interior come from a direction approximating the north-west, reaching the coast in the summer as hot winds; and besides the amount of matter raised by those winds alone, they are undoubtedly fed in a small way by whirlwinds. A careful study of the distribution of several species between the Bogan and Lachlan will show that the spread has been towards the south-east. Two species in particular may be mentioned as having travelled in this way, viz., *Acacia aneura* (Mulga) and *A. excelsa* (Ironwood) (*Vide* Part iv., p. 321). It is possible that there are small clumps of Brigalow nearer to Marsden than Nyngan. It may perhaps extend southward from Cobar, but if so, I am satisfied from the result of numerous enquiries made that it is rare. In fact it is scarce anywhere south of the Great Western Railway. I could find neither flowers nor pods the first week in September, and it is curious that various collectors have from time to time experienced a difficulty in getting complete specimens. When the species was first described the pod was said to be unknown, and this part of the description was only supplied by Messrs. Maiden and Betche in 1899 (these Proceedings, 1899, Part iv.), although pods had been collected prior to this later date.

Another instance of this isolation was once noticed in the case of a Eucalypt which was not even supported by seedlings. In the year 1890 my assistant drew my attention to a tree growing about 10 miles west of the road from Young to Grenfell, at a point about midway between these two places. Mr. Quinn, the owner of the land upon which the tree grew, stated that it was the only one of its kind which he had ever seen, never having been in the interior, but a Western man had told him it was a Mallee and that no others were to be found within 50 miles of it. In 1892 I visited Cobar, and at once recognised one of the Cobar Mallees as being similar to the solitary tree near Grenfell. As I did not collect specimens from the Grenfell tree, I cannot speak with certainty, but believe the species to be that which has since been described by Mr. Baker as *E. viridis.* I have also since travelled over most of the area between Grenfell and Wyalong, and have never met with any Mallee within 50 miles of this solitary tree.

Between Parkes, Condobolin and Marsden the total number of Eucalypts noticed was eleven, viz.:—*E. melliodora*, *E. Woollsiana*, *E. hemiphloia* var. *albens*, *E. sideroxylon*, *E. affinis*, *E. conica*, *E. tereticornis*, *E. tereticornis* var. *dealbata*, *E. rostrata*, *E. populifolia* (scarce), and *E. largiflorens* towards Condobolin.

No Mallees were seen within this area, the locality being rather too far east for them, and the country unsuitable through being made up chiefly of river formation,

The Acacias were represented by *A. homalophylla*, *A. pendula*, *A. hakeoides*, *A. decora* (scarce), *A. Oswaldi*, *A. doratoxylon*, *A. amblygona* (on Pinnacle Mountain only), *A. salicina*, *A. stenophylla*, *A. spectabilis* (scarce), *A. acinacea* (?), *A. harpophylla* (west of Marsden), *A. dealbata* (scarce), and *A. dealbata* (green variety).

The Casuarinas were :—*C. Cunninghamiana*, *C. Luehmanni*, *C. quadrivalvis* and *C. Cambagei.*

EXPLANATION OF PLATES.

Plate xxxi.

Fig. 1.—*Acacia pendula*, A. Cunn., (Myall or Boree), Forbes, N.S.W.

Fig. 2 —*Acacia aneura*, F.v.M., (Mulga), Bourke, N.S.W.; *Geijera parviflora* (Wilga), on the left; *Grevillea striata* (Beefwood), a young tree on the right.

Plate xxxii.

Fig. 1.—*Heterodendron oleæfolium* Desf., (Rosewood), Forbes, N.S.W.

Fig. 2.—*Casuarina Luehmanni*, R. T. Baker (Bull Oak), Peak Hill, N.S.W.

Plate xxxiii.

Casuarina glauca, Sieb., on the right near salt water; *C. Cunninghamiana*, Miq., large trees in fresh water.

STUDIES ON AUSTRALIAN MOLLUSCA.

PART V.

(Continued from page 25.)

BY C. HEDLEY, F.L.S.

(Plate xxxiv.)

DAPHNELLA TASMANICA, T. Woods.

A confusion between *D. tasmanica*, T. Woods (P.R.S.Tas. 1877, p. 138) and *Cithara tasmanica*, T. Woods (P.R.S.Tas., 1875, p.145) caused me to erroneously state (these Proceedings, 1900, p. 725) that Pritchard & Gatliff had united *Mangilia jacksonensis* with the former, whereas it was with the latter that they have correctly identified it.

AMAUROPSIS MOERCHI, Adams & Angas.

(Plate xxxiv., figs. 19, 20.)

In the first part of these Studies, I gave a figure of what I believed to be this species, but which I now withdraw. My identification was, as Dr. Dall, Prof. Tate and other correspondents pointed out to me, a generic error. Mr. Brazier has since furnished me with two examples of *A. moerchi*, one from a point four miles north of Ballina, N.S.W., the other from Double Bay, Sydney Harbour. The Ballina specimen, represented in my figure, though slightly broken, is 11 mm. long. From the Sydney shell I have derived the operculum (fig. 20), and by its help have slightly "restored" the shell.

MUREX PLANILIRATUS, Reeve.

Reeve, Conch. Icon. iii., Murex, pl. xxxi., sp. 149, 1845.

In my opinion the species described by Brazier as *Murex polypleurus** should be reduced to a synonym of this. Apparently

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the same species is recorded by Menke* as *Fusus pallidus*, Broderip, from Western Australia. Since Broderip stated† that his species came from the Falkland Islands, the identification of Menke seems improbable.

SCALARIA BALLINENSIS, Smith.

Smith, Ann. Mag. Nat. Hist. (6) vii., 1891, p. 139.

(Plate xxxiv., fig. 21.)

Four specimens collected near Ballina, N.S.W., by Mr. J. Brazier, furnished Mr. Smith with the means of describing this species; the burden of illustrating it he left for others. A series, the original lot from which Mr. Smith was supplied, has lately reached me. Their examination convinces me that *S. ballinensis* is a synonym of the common, widespread and variable *Scala granosa*, Quoy & Gaimard. A smooth state appears to have been studied by Smith. My figure is based on a well sculptured Ballina shell, 15 mm. long.

TURBO EXQUISITUS, Angas.

Angas, P.Z.S., 1877, p. 175, pl. xxvi., f. 18.

(Plate xxxiv., fig. 7.)

No mention has been made of the operculum of this species. I find that externally it is white, microscopically granulated, with a thick raised spiral rib of three revolutions. This feature indicates a relationship between it, *T. gruneri* and *T. stamineus*. The specimen, from the Sow and Pigs Reef, containing the operculum here figured, is much larger than that Angas described, being 19 mm. in length, 17 mm. in major diameter, and 15 mm. in minor diameter.

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* Menke, Moll. Nov. Holl. Spec. 1843, p. 26.

† Broderip, Proc. Zool. Zoc. 1832, p. 194.

COLUMBELLA PLEXA, n.sp.

(Fig. 25.)

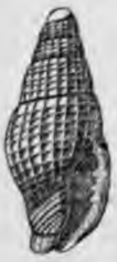

Fig. 25.

Shell small, clathrate, bluntly fusiform, a little contracted at the base, polished, semi-diaphanous but rather solid. Colour pale brown, suddenly changing to darker on the base. Including a smooth globose, two-whorled protoconch, the whorls are five, flattened, parted by a channelled suture, the last twice the length of the spire. Sculpture: about twenty close narrow regular sharp longitudinal ribs descend the shell perpendicularly, continuing after each sutural gap from whorl to whorl and vanishing gradually on the base; the interstices of these longitudinals are interwoven by finer, closer and less prominent spiral cords, which extend past the longitudinals to the anterior extremity, numbering 14 on the last whorl and 5 on the spire. Aperture slightly ascending, not thickened externally, narrow, perpendicular, denticulated within by several (3-5) entering ridges. Canal short, recurved. Length 4·5, breadth 1·7 mm.

Hab.—Ladies' Hall Beach, near South Head, Sydney Harbour; two specimens (H. L. Kesteven).

Type to be presented to the Australian Museum.

To the kindness of H. L. Kesteven I owe both the opportunity of describing this species and the excellent drawing which illustrates it. The present is readily known from any other small Australian *Columbella* by the reticulate sculpture.

HALIOTIS SEMIPLICATA, Menke.

Menke, Moll. Nov. Holl. Spec. 1843, p. 32.

This rare West Australian shell has not been recognised by any succeeding writer. Tate in his review of Menke's shells passes it without comment.* Pilsbry consigns it to the list of unidentified species.†

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* Tate, Proc. Linn. Soc. N.S.W., vi., p. 401. 1882.

Mr. A. U. Henn collected on the Cottesloe Beach, about four miles north of Fremantle, W.A., and sent to me a shell which I have identified with this long lost species. Further, it seems to me certain that *Haliotis lauta*, Reeve,* collected by Lieut. Preston at the "Swan River Settlement," is the same as Menke's species. I note that though Reeve's figure is the exact length given by Menke for *H. semiplicata*, yet it is 4·5 mm. narrower than the breadth of *H. semiplicata*. As the specimen from Cottesloe is of broader proportions than Reeve's illustration, I attach no importance to this discrepancy.

PUNCTURELLA GALERITA, n.sp.

(Fig. 26.)

Shell elevated, small but rather solid, summit overhanging the base, posterior side incurved, anterior steeply sloped. Colour dull white (bleached?). Sculpture: about 20 low spiral ribs arise by interstitial growth, broaden rapidly, denticulate the margin and imprint the interior, the posterior rib dominating its fellows; indistinct growth-striæ cross the ribs and their narrow interstices; the whole surface is granulate. The apex is inrolled, of at least one whorl, vertical, with a median sinus. The perforation is a narrow slit, taking the place of two furrows and the posterior rib on the crown of the shell. The interior shelf stretches far down. Aperture oval. Height 2 mm. Aperture 2·2 by 1·6 mm.

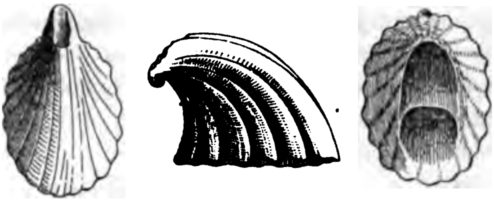

Fig. 26.

Hab.—Darnley Island, Torres Straits (Chevert Expedition).

Type in the Macleay Museum.

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* Reeve, Conch. Icon. iii. Haliotis, Pl. xvii., sp. 68, July, 1846.

Since writing the above I have taken this species in 15 fathoms off the Palm Islands and have seen examples gathered at Bundaberg by Dr. T. H. May. Probably this, not *P. kesteveni*, was the unnamed species collected by the Challenger in Torres Straits.

PHILINE TRAPEZIA, n.sp.

(Plate xxxiv., figs. 22, 23, 24.)

Shell minute, thin, diaphanous, trapezoidal, the base meeting the side at almost a right angle, with a narrow umbilical groove. Colour pale yellow. Sculpture: spire puckered into a few coarse longitudinal ridges, the remainder of the shell densely covered with close fine raised spiral lines, parted by interstices of equal breadth; on high magnification the raised lines develop into chains (fig. 24). The lower columella follows a C curve; above the umbilical groove it stands out from the whorl as a wavy ridge, terminating posteriorly in a sharp transverse callous ledge. The spire is plane, of two whorls separated by a deeply channelled suture; the apex is immersed. Length 1·9, breadth 1·3 mm.

Hab.—Off Shark Point, Sydney Harbour; 12 fathoms, on a bottom of mud and weed (J. Brazier).

Type to be presented to the Australian Museum.

This species is apparently allied to the British *P. scabra*, Müller. Probably *Scaphander multistriatus*, Brazier (these Proceedings, 1900, p. 510) should follow this into *Philine*.

MARINULA PATULA, Lowe.

(Plate xxxiv., fig. 18.)

The synonomy of this species is given by Tate & May (*ante*, p. 419). Mr. Brazier tells me that he was informed by Mr. A. E. Smith that *Auricula cymbaeformis*, Recluz (Pfeiffer, Mon. Auric. p. 63) also belongs here. As the only illustration of this shell is in a rare work not generally accessible to students, I add a drawing of an old and incrassate specimen from Middle Harbour, 10·5 mm. in length.

FLAMMULINA SPALDINGI, Brazier.

Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 103.

(Plate xxxiv., figs. 9, 10, 11.)

These drawings are taken from a specimen collected by Mr. Brazier at Bet Island, Torres Straits, which measures, height 2·1, major diameter 4, minor diameter 3·6 mm.

F. SPALDINGI var. CARINATA, Brazier.

Brazier, Proc. Linn. Soc. N.S.W., iv., 1880, p. 393.

(Plate xxxiv., fig. 8.)

To the same scale as the above is drawn an example of this marked variety from Thursday Island.

TORNATELLINA MASTERSI, Brazier.

Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 108.

(Plate xxxiv., figs. 13, 14.)

One of the types from Darnley Island, 2·9 mm. in length, is shown at fig. 14. An example of *T. petterdi*, Brazier (*op. cit.* p. 109) from No. iii. Barnard Islands, 2·7 mm. long, is represented by fig. 13. It seems to me an immature state of the same species. *T. grenvillei*, Brazier (*op. cit.* p. 109) appears from a study of the types also to be identical with *T. mastersi*. To this species belongs also a *Tornatellina* from Boyne Island, and Warroo, Queensland, identified* as *T. eucharis*.

The double twist on the columella distinguishes this from the very similar *T. oblonga*, Pease, of the Central Pacific. *T. jacksonensis*, Cox, is a more slender shell.

TORNATELLINA EUCHARIS, Brazier.

Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 110.

(Plate xxxiv., fig. 12.)

One of the two type specimens from No. iii. Barnard Islands, 2·5 mm. long, is here shown. I am doubtful if it be not the young of *T. wakefieldæ*, Cox.† *T. eucharis* occurred to me on Fitzroy Island, Q. *T. aperta*, Pease, seems closely allied.

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* Hedley & Musson, these Proceedings (2) vi., 1892, p. 558.

† Hedley, Records Aust. Mus., iii., 1899, p. 153, pl. xxviii., f. 14.

DITROPIS MACLEAYI, Brazier.

Cyclophorus (Ditropis) beddomei, Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 113, *non* Blanford, 1869; *C. (D.) macleayi*, Brazier, *op. cit.* ii., 1877, p. 122, *nom. mut.*

(Plate xxxiv., figs. 15, 16, 17.)

One of the types from Cape York (1·9 maj. diam., 1·4 minor diam., 1·2 mm. height) is here shown. The operculum contained in another specimen is not that of *Ditropopsis*. The description is inaccurate regarding the number and position of the keels.

THEORA FRAGILIS, A. Adams.

A. Adams, P.Z.S., 1855, p. 226.

(Plate xxxiv., figs. 4, 5, 6.)

The shell here figured came from Lane Cove near Sydney; it is 13·5 mm. long and 7 mm. high. Apparently it is the species identified by Angas* as *Theora nitida*, Gould,† a Japanese species. Gould himself doubted whether his species was not a small and slender form of *T. fragilis*, the type of which is from Moreton Bay, Queensland. In a suite of *Theora* I gathered at Cardwell, Queensland, small specimens exactly like the Sydney shells pass gradually into a shell 18 mm. long, with a sinuate ventral margin. I have not the material to decide whether the Japanese species is identical with the Australian, but under the circumstances it seems best to replace Gould's name by Adams' for the local species.

We are informed by Smith‡ that Adams blundered grossly in describing the dentition of this shell.

MODIOLARIA SPLENDIDA, Dunker.

(Plate xxxiv., fig. 1.)

Under the name of *Volsella splendida*, this species was described by Dunker§ as from California, probably an erroneous locality, for Mr. C. T. Simpson, of the U.S. National Museum, writes to me that he does not know this species as American. Then it was figured by Reeve* as *Lithodomus splendidus*, from Sydney. Neither the change of genus or of habitat is explained by Reeve. As regards his classification, he was perhaps influenced by Chenu, who figured the species† as *Botula splendida*. Chenu's mistaken reference of this species to *Botula* has been disastrous.

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* Angas, P.Z.S., 1867, p. 914.

† Gould, Proc. Boston Soc. Nat. Hist., viii., p. 24, March, 1861.

‡ Smith, Chall. Rep., xiii., 1885, p. 90.

Mörch‡ introduced *Botula* as a subgenus of *Lithophaga* (*Lithodomus* according to Reeve), and named two species under it, *Modiola vagina*, Lam., and *Mytilus fuscus*, Gmelin. In effect Chenu substituted another type and misled Stolickza,§ among others, into placing a wrong interpretation on Mörch's genus.

M. splendida is nearly related to *Modiolaria barbata*, Reeve.|| By their hirsute epidermis these differ from the typical expression of the genus.

M. splendida seems a rare shell. It is recorded by Whitelegge¶ as found off George's Head, Sydney Harbour, and it has been collected by Mr. J. Brazier at Ballina, N.S. Wales.

SPISULA PARVA, Petit.

(Plate xxxiv., figs. 2, 3.)

This common, estuarine and gregarious bivalve varies considerably in size and shape. Several names have been bestowed upon it, and though the synonomy has not before been consolidated it has in part and locally been recognised. The exterior has has been several times figured, but the accompanying sketches drawn from a Sydney specimen 29 mm. long are the first to deal

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* Reeve, Conch. Icon. x. Lithodomus, pl. v , f. 31, Jan. 1858.

† Chenu, Man. de Conch., Pt. ii., p. 156, fig. 775, 1859.

‡ Mörch, Cat. Conch. Yoldi, p. 55, 1855.

§ Stolickza, Cretac. Fauna South India, iii., pp. 370, 375-6, 1871.

|| Reeve, Conch. Icon. x. Lithodomus, pl. v., f. 27.

¶ Whitelegge, Journ. Roy. Soc. N.S.W., xxiii., 1889 (1890), p. 244.

with the hinge. The following in chronological order are the names applied to it:—

1. *Gnathodon parvum*, Petit, Journ. de Conch. iv. 1853, p. 358, pl. xiii., ff. 9, 10; Sowerby, Conch. Icon. xix, 1873, pl. i., f. 6. Moreton Bay, Q.
2. *Mactra rostrata*, Reeve (not of Spengler, 1802, nor of Philippi, 1846), Conch. Icon. viii., 1854, pl. xix., f. 104. Collected by F. Strange in Moreton Bay, Q. Dall unites (Proc. U.S. Nat. Mus. xvii., p. 106) this with the foregoing as *Spisula parva*, Petit.
3. *Mactra corbuloides*, Deshayes, Proc. Zool. Soc. 1854, p. 63; Reeve, Conch. Icon. viii., pl. xix., f. 103. Locality unknown.
4. *Spisula cretacea*, Angas, Proc. Zool. Soc. 1867, p. 909, pl. xliv., f. 6. Port Stephens, N.S.W.
5. *Spisula producta*, Angas, Proc. Zool. Soc. 1867, p. 909, pl. xliv., f. 7. Port Jackson, N.S.W.
6. *Mactra fluviatilis*, Angas, Proc. Zool. Soc. 1871, p. 20, pl. i., f. 31. Hawkesbury River, N.S.W. On the authority of Brazier these three species of Angas are united by Whitelegge (Journ. Roy. Soc. N.S. Wales, xxiii., 1889 (1890), p. 236).

EXPLANATION OF PLATE XXXIV.

Fig. 1.—Interior of left valve of *Modiolaria splendida*, Dunker.
Figs. 2, 3.—Hinges of *Spisula parva*, Petit.
Figs. 4, 5, 6. Different aspects and hinge of *Theora fragilis*, A. Adams.
Fig. 7. Operculum of *Turbo exquisitus*, Angas.
Fig. 8.—*Flammulina spaldingi* var. *carinata*, Brazier.
Figs. 9, 10, 11.—Various aspects of *Flammulina spaldingi*, Brazier.
Fig 12.—*Tornatellina eucharis*, Brazier.
Fig. 13. *Tornatellina petterdi*, Brazier.
Fig. 14.—*Tornatellina mastersi*, Brazier.
Figs. 15, 16, 17. Various aspects of *Ditropis macleayi*, Brazier.
Fig. 18.—*Marinula patula*, Lowe.
Figs. 19, 20.—Shell and operculum of *Amauropsis moerchi*, Adams & Angas.
Fig. 21.—*Scalaria ballinensis*, Smith.
Figs. 22, 23, 24.—Different aspects and sculpture of *Philine trapezia*, Hedley.
All enlarged and to various proportions.

THE PROTOCONCHS OF CERTAIN PORT JACKSON GASTEROPODA.

By H. Leighton Kesteven.

(Plates xxxv.-xxxvi.)

In the "Catalogue of Tertiary Mollusca in the British Museum" (Introduction, p. xiv.) Harris says:—"I have found that the greatest difficulty in defining the brephic [or nepionic] stage is in those cases where a strong varix has been thrown up at the conclusion of the embryonic stage, and it seems right that this should be so. For the varix *certainly indicates a pause in the growth of the shell, and it is reasonable to suppose that during that pause the animal was passing through the brephic stage*, but did not continue to make the normal shell of that period, except partially, it may be, in some instances. I have even doubted whether in certain instances *the varix alluded to was not, in fact, the only manifestation of the growth of the shell during the brephic [or nepionic] stage.*" The italics in both instances are mine.

In some of the shells discussed here, especially ***Murex australis***, the sculpture of the shell which follows the "varix thrown up at the conclusion of the embryonic stage" is, in miniature, that of the adult. The original of fig. 11, pl. xxxv., is on that account identifiable without obtaining a series.

The auxological terms of Professor A. Hyatt apply to morphological not conchological periods of growth. That being so, it seems to the writer that the nepionic stage of the marine Gasteropoda may be defined thus:—that stage in which the embryo, having reached its full development, loses its embryonic characters and assumes its adult form. If this be right, that there should be a pause in the growth of the shell is only natural, and I would suggest that it may be that where no varix has been thrown up the mollusc has left no conchological record of the nepionic period.

The arguments which might be advanced in support of this suggestion are of necessity only deductive and analogous, and therefore not conclusive; but they are sufficiently so to defend my use of Hyatt's term ananeanic (Hyatt, Zool. Anz. No. 427, 1893, p. 327) for early adult structure instead of the term brephic (= nepionic) used by Harris (*loc. cit.*).

It will be noticed that the descriptions are of "Protoconchs" and "Apices." The distinction is perhaps arbitrary, but nevertheless useful. The former term is applied to a detached embryo, the latter to one which is attached to some adult structure.*

Before proceeding to describe the apices, it may be deemed fitting to give an account of my mode of identifying them. Whilst sorting sand, shells are met with which are at once recognisable as young; these are the material on which I start to work. In some instances specimens consisting of a protoconch and only one adult whorl are identifiable, but in most cases a series illustrating the growth up to the paraneanic and even the ephebic stages, is needed before the young can be identified with certainty. *Murex australis*, Quoy & Gaim., is illustrative of the former instance, whilst *Tritonium fusiforme*, Kiener, is illustrative of the latter. I had to obtain an almost complete set of specimens, that is, a series illustrating almost every stage in the growth of the shell, before I could determine its young satisfactorily. I have found it more practical to obtain the young shells first and refer them to adults, than to take an adult shell and determine to find its young. I would warn students from identifying young shells hastily; some of them are very deceptive; for example, the sculpture and general appearance of *T. fusiforme* up to the end of the paraneanic stage are so suggestive of *T. exaratus*, Reeve, that I at once put it down as the young of that species, and it was only when I had obtained a large series of the latter that I discovered my mistake. Such an instance as this calls for a most careful examination of every species dealt with.

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* For the purposes of this paper I have found it convenient to speak of all post-embryonic structure as adult structure.

The protoconchs treated of in this paper have occurred to me in sand from various bays in and around Port Jackson, and have been identified in the manner described above.

MUREX AUSTRALIS, Quoy & Gaim.

(Plate xxxv., figs. 10-11.)

Protoconch balloon-shaped, imperforate, solid, brick-red fading to yellow at the tip, consisting of about one and one-half whorls, defined by a rounded varix; devoid of an epidermis; sculptured with slightly waved transverse ribs, as broad as their interstices, and with very fine punctured revolving groove liræ, the transverse sculpture becoming fainter towards the tip, leaving the first half whorl ornamented only by the revolving liræ, the absolute nucleus being almost smooth. Mouth almost round, but the short, broad canal gives it a pear-shaped appearance. Outer lip thick, well rounded. (The specimen figured shows the commencement of the adult structure from inside the variced lip). Inner lip thin, well defined. Pillar twisted. Anterior canal short, rather wide and shallow; there is no sign of a posterior canal. Dimensions of protoconch, length 2, breadth 1·5 mm.

MUREX ANGASI, Crosse.

(Plate xxxvi., figs. 6-7.)

Apex thin, semi-pellucid, of about three-quarters of a whorl, defined by a varix, devoid of an epidermis, its surface polished, showing only very fine growth-lines. The whorl is obtusely angulated high up, the varix is prominent up to this angle, where it ceases, the transition from embryo to adult being marked on the top of the whorl by a slight groove only, the tip of the nucleus depressed.

I have not obtained the protoconch detached. Fig. 6 represents the youngest example I have. The dimensions of this specimen are, length 2·3, breadth 1·3 mm.

TRITONIUM FUSIFORME, Kiener.

(Plate xxxv., figs. 3-5.)

Protoconch ovoid, umbilicate, thin, semi-pellucid, shining, corneous, light brown, variously marked with spots or stripes of darker colour, consisting of about three whorls, covered with a very thin light brown epidermis. Transversely sculptured with very fine growth-lines; the epidermis supplies four ciliated ridges which encircle the last whorl, the top one of which is continued on the earlier whorls. Mouth nearly ovoid; outer lip thin, well rounded, and very slightly reflected; inner lip undefined; pillar short, slightly bent. Anterior canal merely indicated by a broad shallow sinus. Umbilicus small, and owing to the transparency of the shell only seen in certain lights. The transition from embryo to adult is marked by a very slight reflection of the outer lip of the embryo and the complete change of the shell-structure. Dimensions of protoconch, length 2, breadth 1·9 mm.

TRITONIUM OLEARIUM, Linn.

(Plate xxxv., figs. 4-5.)

Protoconch thin, attenuately conical, imperforate, semi-pellucid, shining, corneous, light brown, consisting of six whorls, under the microscope very finely transversely and longitudinally lirulate, covered with a very thin, light brown epidermis. Mouth somewhat ovate; outer lip thin, rounded; inner lip distinct; pillar slightly bent back anteriorly. Anterior canal distinct under the pillar but undefined on the outer lip. The junction of the embryonic with the adult structure is marked by a slight varix and a complete change of structure. A few coarser transverse lines may be noticed on the body whorl of the embryo just before its junction with the adult. Dimensions of protoconch, length 4·3, breadth 2·5 mm.

The general appearance of this protoconch is that of an *Alaba*, and but for the anterior canal might be mistaken for one. It looks peculiarly out of place standing up from the rather flat crown of the early adult whorls.

If the whole of the embryonic life is spent as a pelagic existence, the wide distribution of this species is easily explicable.

TRITONIUM SPENGLERI, Chem.

(Plate xxxvi., figs. 8-9.)

Apex thin, semi-pellucid, corneous, shining, consisting of four and one-half whorls, covered with a thin brown epidermis, very finely transversely and longitudinally lirulate. Junction of embryo and adult marked by a broad flat varix and a complete change of structure. Dimensions of protoconch (approximately), length 3, breadth 2 mm.

The peculiar oblique way in which the apex is set on the adult whorls is unique. The above dimensions are taken from the specimen figured.

TRITONIUM SPECIOSUM, Angas.

(Plate xxxvi., figs. 10-11.)

Apex solid, slightly polished, dull yellowish-brown, consisting of a little more than one whorl, sculptured with fine revolving hair-lines, which are broken up into irregular lengths. The junction between embryonic and adult structure is marked by a small varix and a complete change of structure. Dimensions of specimen figured, length 3·5, breadth 1·5 mm.

GYRINEUM AUSTRALASIA, Perry.

(Plate xxxvi., fig. 1.)

Ranella leucostoma, Lam. (*vide* Mr. Hedley's Note on this synonymy, *ante*, p. 631).

Apex solid, polished; colour variable, of different shades of brown; consisting of about five whorls, perfectly smooth and devoid of an epidermis. The junction between embryo and adult is marked by the sudden acquisition of a complex sculpture. Dimensions of protoconch (approximately), length 5·3, breadth 4 mm.

Although this apex has a thoroughly strong appearance, it is generally dropped early in the life of the adult mollusc, half grown specimens with their apices on being rare. It has occurred to me that this apex, like that of *Scaphella*, may have been deposited inside an original corneous one which was discarded in, or soon after the mollusc left, the egg-capsule.* The above measurements of the protoconch are taken from the specimen figured.

SISTRUM NEGLECTUM, Angas.

(Plate xxxvi., fig. 2.)

Apex thin, semi-pellucid, polished, devoid of sculpture and epidermis, of about one and one-half whorls. The protoconch is not sharply defined, but the acquisition of a slight sculpture suggests the termination of the embryonic structure Dimensions of the specimen figured, length 3, breadth 1·5 mm.

CAPULUS VIOLACEUS, Angas.

(Plate xxxv., figs. 7-9.)

Apex of a little more than one whorl, devoid of an epidermis, thin, brown, smooth, shining. The specimen figured shows a division between the embryonic whorl and the succeeding adult whorl; this is not always present. I have seen specimens which show no such division. Fig. 9, pl. xxxv., represents the ananeanic sculpture from a specimen slightly older than the one figured. The embryonic structure is defined by the acquisition of sculpture. Greatest diameter of the protoconch 1 mm.

LIOTIA CLATHRATA, Reeve.

(Plate xxxv., fig. 6.)

Apex of one whorl, slightly depressed, thin, smooth, white, semi-pellucid, shining, defined by the acquisition of sculpture. Greatest diameter of protoconch 1·5 mm.

The neanic structure of this species is perhaps more interesting than the protoconch. So unlike the full grown shell is it that for a long time I was at a loss to know what the specimens were. The revolving riblets which so mark the adult shell are entirely absent, and the whorls, instead of being most prominently angulated at the lower periphery, are only angulated superiorly; but the character which most disguises the young shell is its stellate form. The fine transverse hair-lines which may be seen between the transverse and longitudinal riblets of a fully grown shell are closely and uninterruptedly packed all over the upper surface of a young specimen. But for the deep sutural groove, the figure represents a similar stage in the growth of *Liotia subquadrata*, T. Woods.

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* See Dall, Bull. Mus. Comp. Zool. Harvard Coll., Vol. xviii., 1889, p. 452.

TURBO STAMINEUS, Martyn.

(Plate xxxv., figs. 1-3.)

Apex of one and one-half whorls, depressed, thin, semi-pellucid, white, smooth, defined by a thickening of the shell and a loss of the porcellanous appearance. Light reflected up the perspective umbilicus may be seen shining through the apex. Greatest diameter of the protoconch 1·5 mm.

The shell at the stage figured is generally bleached a dull white, but I have a specimen in which the ananeanic structure is variegated with bright crimson and green, and ornamented round the suture with light blue blotches. The specimen figured shows the commencement of the broad sutural gutter.

EXPLANATION OF PLATES XXXV.-XXXVI.

PLATE XXXV.

Figs. 1-3.—*Turbo stamineus*, Martyn; young.
Fig. 4.—*Tritonium olearium*, Linn.; protoconch attached.
Fig. 5.— „ „ „ ; protoconch.
Fig. 6.—*Liotia clathrata*, Reeve; young.
Figs. 7-8.—*Capulus violaceus*, Angas; young.
Fig. 9.— „ „ „ ; sculpture of same.
Fig. 10.—*Murex australis*, Quoy & Gaimard; protoconch.
Fig. 11.— „ „ „ „ ; protoconch attached.

PROTOCONCHS OF CERTAIN PORT JACKSON GASTEROPODA.

Plate xxxvi.

Fig. 1.—*Gyrineum australasia*, Perry; protoconch attached.
Fig. 2.—*Sistrum neglectum*, Angas; showing the apex.
Fig. 3.—*Tritonium fusiforme*, Kiener; protoconch attached.
Fig. 4.— ,, ,, ,, ; first adult whorl.
Fig. 5.— ,, ,, ,, ; protoconch.
Fig. 6.—*Murex angasi*, Crosse; protoconch attached.
Fig. 7.— ,, ,, ,, ; a somewhat older specimen showing the protoconch from the other side.
Fig. 8.—*Tritonium spengleri*, Chemnitz; protoconch attached.
Fig. 9.— ,, ,, ,, ; an older specimen illustrating the oblique position of the protoconch.
Fig. 10.—*Tritonium speciosum*, Angas; protoconch attached.
Fig. 11.— ,, ,, ,, ; sculpture of the protoconch.

ON THE SKELETON OF THE SNOUT OF THE MAMMARY FŒTUS OF MONOTREMES.

By Professor J. T. Wilson, M.B., Ch.M.

(Plates xxxvii.-xlii.)

At the Meeting of the Society, held March 28th, 1900, I exhibited photographs and wax-plate reconstructions illustrating the anatomy of the snout of the so-called mammary fœtus of Ornithorhynchus and Echidna. A brief preliminary account of the conclusions arrived at was published in the Proceedings of the Society (1).

The present paper aims at presenting a more ample and detailed account of the facts, accompanied by the necessary illustrations.

The material employed in the investigations which form the subject of this paper included, in addition to adult specimens of both Monotremes—(A) the snout of a "mammary fœtus" of Ornithorhynchus, whose external characters were described by me in a former communication to the Society (2), and which was originally placed at my disposal by the Trustees of the Australian Museum; (B) a "mammary fœtus" of Echidna of almost precisely the same stage of development as the younger of two specimens described and figured by Professor W. Newton Parker (3). Both Professor Parker's and my specimen were obtained by the courtesy of the Trustees of the Australian Museum, though at widely different times. (C) Another and larger "mammary fœtus" of Echidna in my possession I owe to the generosity of my colleague Professor W. A. Haswell, F.R.S. (D) Through the kindness of Mr. J. P. Hill I have had access to a series of coronal sections of the snout of a larger "mammary fœtus" of Ornithorhynchus, of almost the same size and general stage of development as that originally described and figured by Professor W. K. Parker (4), and again subsequently figured by Professor E. B. Poulton (5).

To the gentlemen who have thus assisted me with valuable material I desire to offer my grateful acknowledgments.

The investigation has been carried on chiefly by means of serial sections of the snout region. The sections were stained in hæmatoxylin and picric acid. Wax-plate reconstructions were made of the skeletal structures of the snout region of each of the specimens, with the exception of C. The scale of magnification employed for this purpose was 40 diameters. In the case of Model i., (younger Ornithorhynchus) serial photographs of the sections were traced directly, with thin manifolding carbon paper, upon the surface of the wax-plates. In the case of the other two models the drawings were made by tracing the image thrown on the screen by the projection microscope, and then re-tracing with the thin carbon paper directly upon the surface of the wax. This has been found very convenient and greatly preferable to the inclusion of the paper basis of the drawing in the wax-plate according to Born's later method.

For the figures illustrating this paper I am indebted to my wife, as also for valuable assistance in the preparation of the reconstructions. The figures representing the models have been drawn from the models themselves, after photographs reduced to a scale of about five-twelfths of the originals. The sectional anatomy of the snout of the younger Ornithorhynchus is further illustrated by the series of figures 13-21, which were drawn with the aid of the Edinger's drawing-apparatus to a scale of enlargement of 18 diameters.

I wish also to acknowledge the skilful assistance I have received from my laboratory assistant Louis Schaeffer, both in the preparation of the wax-plates and in photography of the models.

I.—THE CARTILAGINOUS ROSTRAL SKELETON IN THE MONOTREMES.

In 1893 an important advance towards a more correct interpretation of the cartilaginous skeleton of the anterior nasal region of Ornithorhynchus was made by Dr. C. J. Martin in collaboration with the present writer (6).

It was then shown that the "large sheet of hyaline cartilage forming the outline of the great rostrum" previously noted by Kitchen Parker (4), is continuous with the septum nasi. The latter, on being traced forwards in the adult, was found to divide into a smaller dorsal, and a more massive ventral, subdivision. It was shown that the ventral portion descends and is intercalated into the anterior part of the roof of the mouth, and, rapidly widening out, is prolonged forwards into continuity with the large rostral cartilage. This again is continuous laterally with the alinasals, and, extending forwards between the diverging premaxillary crura, spreads both forwards, outwards, and backwards to form the peculiar marginal cartilaginous support of the upper lip—the "valance of solid hyaline cartilage" described by Parker. The rostral cartilage thus described was identified with the "prenasal portion of the axis of the embryonic chondrocranium." The anatomy of the region dealt with was illustrated by a series of figures of transverse sections through the adult snout, and by a drawing (*loc. cit.*, fig. 17) showing the main outlines of the bony and cartilaginous snout-skeleton as seen from the ventral aspect.

It is now desirable to amplify, and in some measure to correct and reinterpret, the details of the description epitomised above, in the light of further observations, both upon the adult by Broom (7), and upon immature specimens of both Monotremes by the writer.

Whilst expressing his entire agreement with the interpretation of the rostral cartilage in the adult Ornithorhynchus given by Wilson and Martin, Broom contributed to the anatomical description highly important observations of his own. He found that "the rostral cartilage does not extend forward to the front of the beak as an entire sheet. Almost immediately in front of the plane passing through the anterior part of the premaxillaries, the cartilage becomes abruptly arrested in the middle line; but while this is so, the lateral parts extend forward almost to the front of the beak, where they again approach each other, meeting, or almost so, in the middle line. There is thus left in the middle an oval space entirely free from cartilage. This arrangement I have found in three different individuals (two males and one female). The lateral portions of the cartilage curve round backwards along the outer sides of the rostral crura, supporting the lip as shown by Wilson and Martin. It seems probable that this whole complicated marginal cartilage is a development of the prenasal. . ."

Broom's interpretation of his facts is worthy of special remark, since its correctness is largely borne out by the facts of development as shown by the reconstructions of the fœtal snout now figured. Referring to the dorsal subdivision of the nasal septum, he says:—"Though in the region of the anterior nares it is considerably removed from the prenasal plate" [which is continuous with the ventral moiety of the septum nasi] "on passing forwards it approaches the latter, and ends in close connection with it, at the point where the prenasal becomes arrested in the middle line. This point" [marked with an asterisk in his fig. 1, which should be consulted] "probably represents the anterior end of the beak in the ancestor of the Platypus, as not only do the two cartilages here end together, but this is practically where the two premaxillaries would meet if they came together. Connected with it, moreover, there is a further feature of importance. On the upper side of the beak in the middle line is a small thickened area of epithelium (*c* in fig. 1) unlike that of the rest of the beak. This is probably the remains of the caruncle. If it be so, and it is quite perceptible to the naked eye, it corrects the statement of Owen's that no trace of the caruncle can be found in the adult. Whatever be its signification, it is evidently closely related to the supposed apical point of the primitive beak, as a series of fibrous bands pass from it to the latter."

It will presently be shown that the actual condition as seen in the developing snout very nearly corresponds to this interpretation.

The solution of the problem of the snout-cartilage at once appears when it is realised by aid of the wax-plate models that the supposed bifurcation of the septum nasi into dorsal and ventral subdivisions is no genuine bifurcation of the structure, the appearance of such being due to a fenestration of the septum. In point of fact, the dorsal and ventral portions do not merely "end in close connection with one another" anteriorly, "where the prenasal plate becomes arrested in the middle line," but they are actually continuous with one another, and it is this, their point of fusion in front of a somewhat spacious fenestra, which constitutes the true anterior border of the septum nasi—the extreme anterior limit of the strictly axial portion of the embryonic chondrocranium.

Further, in his figure 1, Broom represents the two halves of the marginal cartilage of the lip meeting and uniting in front of the oval gap he discovered; and he speaks (p. 558, line 27) of "their anterior union." But previously (p. 557, line 22) he has used the expression "meeting, or almost so, in the middle line." It is the latter alternative which is correct. The marginal strips of opposite sides do not meet in front, though in the adult they may possibly touch. Thus, in front of what has now been discovered to be the proper anterior edge of the septum nasi there is strictly no cartilaginous tissue present in the mesial plane The anterior edge of the septum is here, as in other mammals, the strict limit of the mesial chondrocranial axis.

Full demonstration of the correctness of these views is afforded by the study of the wax-plate reconstructions upon which this paper is based.

A view of the lateral aspect of the septum nasi in Model i., representing the anterior region of the snout of the younger fœtal Ornithorhynchus, is given in fig. 1. The internasal fenestra above referred to perforates it so close to its anterior end that only a slender median bar of cartilage forms the extreme anterior portion of the septum. A section across the snout in this plane is represented in fig. 15. The posterior border of the fenestra lies slightly in front of the plane at which the lower edge of the cartilaginous septum intercalates itself into the nasal floor t constitute the "prenasal plate." Fig. 17 shows a coronal sectio immediately behind the posterior edge of the fenestra, whilst th section shown in fig. 16 passes through the fenestra.

A corresponding view of Model ii., representing the same regio of the snout in the larger "fœtal" Ornithorhynchus is shown i fig. 5. Here the fenestra is less regularly oval than in the earlie stage. It is becoming vertically more compressed in front.

The same region in the "fœtal" Echidna is illustrated by fig. from Model iii. In its stage of development this specimen corresponds fairly closely to the younger of the Ornithorhynchus specimens. Both as regards the condition of the septum and of the prerostral notch, Echidna at this stage deviates less from the ordinary mammalian condition than does Ornithorhynchus, though there is no essential difference between the two Monotremes.

It was long ago noted by the late Professor W. K. Parker (8) that an internasal fenestra like that now described in the Monotremes is a common feature in low Eutheria. He suggests that it is the posterior margin of such a fenestra which represents the true anterior limit of the septum nasi. We therefore see that it is the specialisation of a not uncommon mammalian character which accounts for much that seems highly peculiar in the Monotreme snout.

I need hardly say that the septal cartilaginous fenestra above described has nothing whatever to do with the internasal defect in the septum of the living Monotreme. The latter is situated altogether posterior to the plane region represented by the present Models.

In fig. 2 we have a view of Model i., from the front (the "os carunculæ" has been removed from the model in order to allow a view of the anterior parts of the snout-cartilage). On either side the lower part of the anterior margin of the septum is seen to expand and to become continuous ventrally with the great cartilaginous sheet prolonged from the nasal floor into the marginal cartilage of the upper lip. As far back as the plane of the anterior end of the cartilaginous capsule of the organ of Jacobson (about level of *s.n'.* in fig. 3), th emarginal cartilage is directly continuous with the cartilage of the nasal floor, of which, indeed, it forms the lateral and anterior expansion. Behind that plane, however, it is severed from the nasal floor cartilage—the maxilla and premaxilla coming to intervene between the two—and is prolonged backwards as a free marginal strip to a point which at this stage is considerably posterior of the plane of the anterior border of the maxillary palate (fig. 3). In front, the marginal cartilage projects forwards on each side into the lip, considerably in front of the plane of the free anterior margin of the septum nasi—*i.e.*, of the primitive anterior end of the snout.

There is thus formed a deep notch between the marginal cartilages of opposite sides. This prerostral notch is the original representative of the oval gap which Broom (7) found in the adult arresting the rostral or prenasal cartilage in the middle line in front. At this stage in development the notch lodges the slender anterior continuations of the premaxillæ which connect the latter with the "os carunculæ" (*v. infra*). The fibrous bands which Broom discovered passing from this region to the vestigial caruncle of the adult can be nothing else but vestiges of these lost premaxillary trabeculæ, together with (and perhaps chiefly) remains of the os carunculæ itself.

Only one of the two premaxillary trabeculæ is shown in this figure occupying the prerostral notch, for the sake of clearness. The ventral view of the model in fig. 3 may be consulted in this connection, in which both the prerostral premaxillary bars are shown, whilst, also for greater clearness, the prerostral extension of the marginal cartilage on the right of the figure has been removed.

The complete cartilaginous ring surrounding the external narial aperture and the upper of the two osseous splints representing the body of the premaxilla are both well seen in fig. 2. Compare figs. 4 (Model i.), 7 and 9 (Model ii.), and figs. 11 and 13 (Model iii.). It will be seen that in the Echidna the cartilage of the aperture is incomplete.

The earlier processes by which the definitive palate of Echid is constituted have been described in detail by Seydel (9) a illustrated by him from wax-plate reconstructions of this regi in stages considerably earlier to those now under consideratio His fig. 8, taf. xv., may be advantageously compared with figs. and 12 of our Models i. and iii., bearing in mind that the latt represent the skeletal structures isolated. On p. 466 Seyd describes the descent of the nasal septum into the plane of t secondary palate :—"Der vorderste Theil der oralen Fläche d Septums welcher bei Embryo 46 dem Gaumenloch entspricht, h sich abwärts in das Niveau der oralen Fläche des secundär Gaumens gesenkt, er verschmilzt mit der hinteren Umrandu des Gaumenloches und verschliesst letzteres bis auf die Oeffnung der beiden Canales naso-palatini." The present models sho however, that in later stages the cartilaginous skeleton of t septum is intercalated in the plane of the secondary palate som little distance in front of the region of the "Gaumenloch," vi at the triangular depression visible in the figures illustrating t ventral aspect of each of the three models.

In treating of the formation of the permanent septum nas Seydel refers to Newton Parker's observation of an internas communication in the young of Echidna (3), and he remarks upo this :—"Vielleicht erhält sich diese Communication auch noch be der erwachsenen Echidna." It is perfectly evident from Parker own words that he had ascertained this actually to be the cas not only in Echidna but in Ornithorhynchus. Seydel is als unaware of the detailed description of this communication in bot Monotremes given independently of, and almost simultaneousl with Parker, by the present writer (10).

II.—THE PREVOMER (DUMB-BELL BONE) AND THE PALATINE PROCES OF THE PREMAXILLA.

In a paper read before the Society in 1894 (10) the writer ha recorded a number of observations on the anatomy and relation of the so-called "dumb-bell-shaped bone" in Ornithorhynchus

It was there suggested that this bone is morphologically an anterior vomerine element. Its homology to at least a portion of the palatine process of the premaxilla of other mammals was also discussed, and was considered by no means incompatible with the vomerine theory propounded by the writer.

In a paper subsequently published in these Proceedings (11), Dr. R. Broom further discussed the homology of the palatine process of the premaxilla in the mammalia generally.

In this paper he summarised the arguments of the present writer in favour of the essentially vomerine nature of the dumb-bell-shaped bone, and held that "these arguments afford conclusive proof that the dumb-bell-shaped bone belongs to the vomerine category and is no part of the premaxilla." He further suggested the term "prevomer" as preferable to that of "anterior vomer," which the present writer, following the nomenclature of W. K. Parker, had already applied to it. He then proceeded to advocate the view, already contemplated by the writer, that the palatine process of the premaxilla in other mammals "is itself a distinct vomerine element, ankylosed or formed in connection with the premaxilla."

A further important view is, however, also put forward, viz., that the so-called vomers of the Lacertilia, which are topographically related to the organ of Jacobson in these forms, are in reality the homologues of the mammalian anterior or prevomers, and not of the mammalian vomer. In support of this doctrine he invokes the authority of W. K. Parker, who would seem to have arrived at a similar conviction.

These views of the nature of the dumb-bell-shaped bone elicited a reply in 1896 from Professor Symington (12), who had previously (13) upheld the theory that the dumb-bell-shaped bone represented neither more nor less than the detached palatine processes of the premaxilla. The paper was written before Dr. Broom's latest contribution reached Europe, though this writer's views were already to some extent known to Dr. Symington through a previous paper by Dr. Broom dealing with the organ of Jacobson in the Monotremata (14).

It is now unnecessary to enter into any detailed criticism of Symington's objections to the theory of the vomerine nature of the dumb-bell bone, as the present writer is of opinion that the *definite* prevomerine homology of at least the greater part, if not of the whole, of the palatine process of the mammalian premaxilla, may now be taken as sufficiently established, and this position practically conserves that view of the homology of the bone for which Symington contended. Indeed in a letter to the writer Professor Symington says, with reference to the dumb-bell bone, that he "does not think there is now much difference of opinion between us as to its homology."

The question of whether the entire palatine process of the premaxilla in mammals is prevomerine, as Broom is disposed to believe, cannot yet be regarded as finally decided. Reason will now be adduced for the belief that the anterior part of this process may originate as a direct backward extension from the body of the premaxilla, whilst the posterior part arises as a distinct prevomerine element. Such a view is very strongly supported by W. K. Parker's investigations on various Eutheria. The figures illustrative of the present paper prove conclusively that it holds *good* for Ornithorhynchus, provided we accept the homology of the dumb-bell bone to *any* portion of the palatine process of the premaxilla in other mammals.

In both specimens of the young of Ornithorhynchus, and also in the young Echidna the main body of the premaxilla is completely divided into dorsal and ventral plates grafted as splints upon the dorsal and ventral surfaces of the wide-spreading cartilaginous plate which forms the chief skeletal element of the snout extending into the lip. These dorsal and ventral parts of the premaxilla are quite distinct from one another, as was surmised to be the case in young stages, in the earlier paper on the snout, contained in the Macleay Memorial Volume (6).

The ventral plate of the body of the premaxilla appears from below as an elongated and curved strip of bone applied to the ventral surface of the cartilaginous plate aforesaid. As seen in Model 1 (fig. 3) it tapers away posteriorly, and is there lodged in a sulcus in the ventral aspect of the antero-lateral extension of the maxilla. Anteriorly it bends mesially and then sends backwards paramesially a pointed palatine process which reaches a point exactly opposite the anterior blind extremity of the cartilaginous capsule of the organ of Jacobson (fig. 1).

The hinder end of this palatine process closely skirts the margin of a triangular mesial depression or fovea, which is due to the descent of the nasal septum and its appearance in the roof of the mouth (*s.n′*), where it merges in the great cartilaginous plate of the snout. This same triangular area is faintly indicated in fig. 17, plate xxiii., of Macleay Memorial Vol., illustrating the adult condition of the cartilaginous skeleton as then conceived. In that adult figure it is seen to lie immediately in front of the dumb-bell bone.

Thus in the young stage under consideration, the palatine process of the premaxilla extends precisely throughout that region where, in the adult, there is no representative whatever of a palatine process of the premaxilla. That this true palatine process of the premaxilla has nothing whatever to do with the production of the dumb-bell-shaped bone is made certain by the examination of the later stage of development illustrated in fig. 7 of Model ii. In this the palatine process of the premaxilla still persists, and is of almost exactly the same length as in the previous stage, not having shared in the considerable growth of the surrounding structures. One result of this is that its position has shifted, relative to the cartilaginous roof of the mouth, so that it now no longer extends as far back as the triangular fovea where the septum first appears in the roof of the mouth. It now also falls considerably short of the anterior end of the capsule of Jacobson's organ. This bony process has thus become arrested in development, and no trace whatever of it is to be found in the adult. But already in this stage (Model ii.) the development of the dumb-bell bone has begun in the shape of two small bony splints applied, one on each side, to the ventral aspect of the cartilaginous capsule of Jacobson's organ. These are visible in fig. 17, plate iii., of W. N. Parker's paper in P.Z.S., 1894 (3), which represents a section through the snout of a young Ornithorhynchus of precisely the same stage of development as that illustrated by Model ii. The section there figured is somewhat posterior of the region represented by Model ii.

These osseous prevomerine splints (=paired rudiments of dumb-bell bone) extend in the specimen itself from about 1 mm. behind the hinder extremity of the true palatine process of the premaxilla, backwards for a distance of 2·6 mm. They begin in front in the plane of the anterior end of the capsule of Jacobson's organ about 1·89 mm. anterior to the anterior margin of Stenson's duct, and end about 0·49 mm. behind its posterior margin. Here their posterior extremities are slightly overlapped by the anterior margin of the transverse cartilaginous lamina which corresponds to that visible in Model i. (fig. 3, *s.p.c.*). This lamina is the same as that transverse strip of cartilage figured in the adult between the dumb-bell bone and the osseous maxillary palate in fig. 17 in the paper in the Macleay Volume already cited (6). It is also shown in my figs. 8 and 9 "*nf.*" in my former paper on the dumb-bell bone (*loc. cit.*), and the relation to the bone is there further indicated by the line "d" in fig. 1 of the same paper (10). But whereas in the adult I have shown the dumb-bell bone to extend backwards into the roof of the internasal aperture there described and depicted, here, in this early stage (specimen D, Model ii.), the posterior extremities (not included in the model) of the paired prevomerine elements as yet fall short of the anterior margin of the aperture by about 0·49 mm.

From this description and from the figs. of Model ii., it is evident that the prevomerine dumb-bell arises autogenously during the interval in development between the stages illustrated by Models i. and ii., and is from the beginning separated by a wide interval from the true palatine process of the premaxilla. The latter has, indeed, obviously been receding in an anterior direction ever since the stage of Model i., in which there was no trace of the prevomerine elements. There cannot, therefore, at any time have been any connection or continuity between the prevomers and the true palatine processes of the premaxillæ. This fact serves to complete the proof originally brought forward by the writer to establish the independent prevomerine character of a much discussed skeletal element. The reconstructions now figured afford complete demonstration of the fact that, quite independent of the prevomer we find a genuine palatine process of the premaxilla. This entirely harmonises with the results of the extensive investigations of W. K. Parker upon the skeletal constitution of this region. The fact that Schwink (15) failed to find evidence of a compound origin of the mammalian palatine process, except in one case, may very probably be explained by the fact that in most mammals in which the premaxilla is well developed, the union of the prevomer and the palatine process proper, takes place very rapidly, so that the stage of distinct ossific centres is a very transient one, if, indeed, it can be said to occur at all as a rule. Here in Ornithorhynchus it is only the arrest in development of the palatine process proper and its progressive absorption in an anterior direction, combined with a rapid lengthening of the snout region and a probable demand for the preservation of the prevomerine element as a skeletal support in the region of Stenson's ducts, which determine the preservation of the isolated posterior element of the so-called palatine process, whilst preventing fusion with the disappearing anterior element or genuine palatine process.

III.—THE OS CARUNCULÆ, A SPECIALISED PRENASAL PORTION OF THE MONOTREME PREMAXILLA.

The caruncle in the young Ornithorhynchus has been recognised since Owen first drew attention to it in 1865 (16). The original idea that it might function in some way similiar to the "egg-breaker" of some Sauropsida has finally been set aside by the more recent discovery of a true "egg-tooth" developed upon the upper lip, in younger stages of development than had previously been examined (*cf.* Seydel, *loc. cit.* (9), and also Taf. x. of Semon's illustrations of young of Echidna (17)).

In a previous paper (2) I have figured the caruncle in the younger of the two mammary fœtuses of Ornithorhynchus now under consideration, whilst Semon has figured earlier conditions of the caruncle co-existing with the "egg-tooth" in the young of Echidna (17).

So far as I am aware, no description of the skeletal basis of the caruncle is extant apart from the abstract I presented at a former meeting of the Society (1).

Seydel (9) has, however, figured without remark (other than the lettering "os incis." and "praem.," "unpaarer Fortsatz beider Zwischenkiefer" in his text-figures 10 and 11) the os carunculæ of Echidna, which is evidently at no time so well developed as it is in Ornithorhynchus.

In fig. 3 (Model i.) the premaxillæ, or rather the inferior lamellæ of them (*px.*), are traceable forwards into the prerostral region where they become attenuated and turn up dorsally into the prerostral notch and in front of the anterior extremity of the septal cartilage. Here the two osseous trabeculæ (*px.*) fuse to constitute a remarkable nodule of bone (*o.c.*) which forms a skeletal foundation for the caruncle. This latter structure, as is evident both from Semon's figures of young Echidna and from similar stages of Platypus, as yet undescribed, which I have had the opportunity of examining, attains a relatively large size and must possess some definite physiological significance, perhaps for the function of lactation, as yet undetermined. In the specimen represented by Model i., the os carunculæ, as I have ventured to name it, has probably already passed the zenith of its development. In the older specimen it is undergoing active resorption and is represented by only partially-connected bony nodules, and is permeated by osteoclasts. In the Echidna specimen represented by Model iii., the os carunculæ is still more rudimentary, although the stage is otherwise almost parallel to the younger of the two Ornithorhynchus. Its original connection with the premaxilla has entirely disappeared, and it itself constitutes only an insignificant oval nodule of bone placed dorsally in front of the upper part of the anterior margin of the septum, remote from the rest of the premaxilla (figs. 9 and 10, *o.c.*).

Even in the younger Ornithorhynchus the interior of the os carunculæ (fig. 22) is in part hollowed away by osteoclastic absorption. Towards the dorsal portion of its interior there appears in successive sections a patch which shows on high power examination a structural character indistinguishable from that of hyaline cartilage, partially calcified, it may be, but which has not yet undergone neoplastic ossification. What the significance of this small and apparently cartilaginous vestige may be, I am unable to determine. Whilst embedded in, it appears tolerably sharply distinguishable from, the rest of the osseous tissue of the caruncle.

The further details of the anatomy of the snout-skeleton of the fœtal Monotreme will best receive elucidation in the course of a description of the plates.

DESCRIPTION OF PLATES.

Plate xxxvii.

Fig. 1 represents a view of the left side of the septum nasi and mesial aspect of the interior of the cartilaginous capsule of Jacobson's organ (*J.c.*), as exposed by a sagittal section of through Model i., to the left of the median plane. The cartilaginous septal fenestra and the profile outline of the os carunculæ (*o.c.*) are well seen. Note also the anterior extremity of the true vomer (*vo.*) and the cross section of the transverse cartilaginous lamina (*s.p.c.*) of the secondary palate.

Fig. 2 gives a view of Model i., from front, foreshortened, with the os carunculæ removed in order to show more clearly the cartilaginous skeleton of the front of the snout. Only one, the right, of the two premaxillary trabeculæ which are continued into the os carunculæ, is figured, and that is cut across at the level of the prerostral notch in which it is lodged.

m.c., marginal cartilage of upper lip, continued behind into the cartilage of the nasal floor, *n.f.*; *s.n.*, anterior margin of septum nasi, forming anterior boundary of cartilaginous fenestra; *al.n.*, cartilaginous roof of nasal cavity formed by alinasal; *px'.*, premaxillary trabecula; *px".*, dorsal lamina of body of premaxilla.

Fig. 3. Ventral aspect of Model i. The os carunculæ (*o.c.*) is seen in front connected by the slender premaxillary trabeculæ (the left one being cut short) (*px'.*) with the ventral lamina of the body of the premaxilla (*px.*) and with the palatine process of the premaxilla (*p.px.*). These latter lie on the ventral

aspect of the cartilaginous nasal floor (*n.f.*) and (*al.n.*), which are continuou in front and laterally with the marginal cartilage (*m.c.*).

s.n'., septum nasi where it descends and is intercalated into and continuou with the cartilage of the nasal floor; *n.p.c.*, naso-palatine foramen (Stenson' duct); *J.c.*, cartilaginous capsule of Jacobson's organ, and *J.c'.*, its posterio extremity; *s.n''.*, edge of ventral border of septum nasi which is largel hidden by the anterior extremity of the vomer, *vo.*; *al.n.t.*, alinasal turbina ridge projecting into the cartilaginous nasal cavity; *n.d.*, nasal duct proceeding along outer surface of alinasal wall of nasal cavity; *n.d'.*, nasal duc passing inwards and piercing alinasal near its ventral border; *mx.*, anterio prolongation of maxilla forming a trough which lodges the posterior end of the ventral lamina of the body of the premaxilla; *mx'.*, palatine plate of maxilla; *s.p.c.*, transverse cartilaginous lamina developed in the secondary palate, its anterior margin forming the true anterior limit of the skeleton of the latter.

Fig. 4. Right lateral aspect of Model i.

o.c., os carunculæ; *s.n.*, septum nasi, anterior border bounding septal fenestra (*fen.*) in front; *c.ap.*, cartilaginous boundary of anterior narial aperture; *al.n.*, alinasal wall of nasal cavity; *n.f.*, nasal floor; *m.c.*, marginal cartilage of snout; *px''.*, dorsal lamina of body of premaxilla; *n.*, nasal bone; *mx.*, maxilla; *n.n.*, nasal nerve; *n.d.n.*, notch in anterior margin of alinasal in which nasal duct turns inwards to open into anterior part of nasal cavity.

Fig. 5. Sagittal section close to left side of septum of Model ii. (snout of larger fœtal Ornithorhynchus).

al.n., alinasals of right and left sides (cut edge of left); *c.ap.*, cartilage o narial aperture; *s.n.*, septum nasi where it forms median bar bounding septal fenestra (*fen.*) in front; *s.n'.*, more posterior portion of septum nasi; *n.f.*, nasal floor, the more vertical dotted line leads to the place where the septum nasi descends to be intercalated into the nasal floor; *J.c.*, cartilaginous capsule of Jacobson's organ; *p.vo.*, prevomer or dumb-bell bone; *p.px.*, palatine process of premaxilla; *px.*, cut surface where ventral lamina of body of premaxilla is continuous with rest of bone; *px'.*, trabecula of left premaxilla continuous through prerostral notch with degenerating os carunculæ, *o.c.*; *m.c.*, rostral ends of left and right marginal cartilages of snout.

Fig. 6. Anterior view of Model ii. There is a considerable amount of necessary foreshortening. The ragged and irregular outline of the degenerating os carunculæ (*o.c.*) is seen continuous with the rest of the premaxilla only through the right trabecula in the prerostral notch, the left having already been absorbed. The nasal duct (*n.d.*) is seen to turn inwards in the notch in front of the alinasal cartilage (*al.n'.*), to reach the nasal cavity; (*m.c'.*), edge of right marginal cartilage. The rest of the lettering as in previous figures.

Plate xxxviii.

Fig. 7. Ventral view of Model ii.

pr.n., prerostral notch, between rostral prolongations of marginal cartilages, *r.m.c.*; *px'.*, anterior trabeculæ of premaxillæ, fused here; *p.px.*, palatine processes of premaxilla; *px.l.*, cut surface of continuity with ventral lamina of left premaxilla; *px.*, ventral lamina of right premaxilla; *n.f.*, nasal floor; *s.n'.*, ventral edge of nasal septum where it enters into constitution of nasal floor; *J.c.*, cartilaginous floor of capsule of Jacobson's organ; *p.vo.*, bilateral prevomerine elements (anterior portions only) representing the dumb-bell ossification.

Fig. 8. Dorsal view of Model ii.

al.n'., anterior border of alinasal cartilage, with nasal duct (*n.d.*) turning inwards in front of it to enter the nasal cavity. Rest of lettering as in other figures.

Fig. 9. Sagittal section close to right of septum in anterior two-thirds, and lateral view of posterior third of Model iii. (fœtal Echidna). Here the os carunculæ is seen as a very small bony nodule (*o.c.*); the premaxillary trabeculæ (*px'.*) extend into, but not through, the shallow prerostral notch, of which only the left boundary (*r.m.c.*), formed by the rostral prolongation of the left marginal cartilage, is seen.

f.J.c., opening in anterior part of capsule of Jacobson's organ; *c.p.*, cartilaginous process prolonged backwards from alinasal wall behind and below narial aperture. Other letters as in other figures.

Fig. 10. Anterior view of Model iii., the right anterior part of the model being cut away.

al.n., cut edge of alinasal continued ventrally into cartilage behind anterior narial aperture; *c.ap.a.*, anterior cartilaginous margin of anterior narial aperture; *c.ap.p.*, the posterior cartilaginous margin of narial aperture. Other letters as elsewhere.

Plate xxxix.

Fig. 11. Ventral view of Model iii.

pr.n., shallow prerostral notch; *px'.*, short and abruptly truncated premaxillary trabecula; *p.px.*, short palatine process of premaxilla; *px.*, ventral lamella of body of premaxilla; *n.p.c.*, cartilaginous gap corresponding to naso-palatine canal; *p.p.c.*, short and isolated cartilaginous rod forming skeletal basis of papilla palatina (*cf.* Broom, 11, "*p.c.*"). This corresponds with the palatine cartilage described by Broom in the papilla palatina of various Marsupials, and figured by him in Perameles (7, fig. 6, "*p.c.*"); *s.p.c.*, is the transverse cartilaginous lamella which develops as the skeletal basis of the secondary palate, and is to be compared with the corresponding lamella in Ornithorhynchus as seen in fig. 3, *s.p.c.*; *al.n.f.*, nasal floor formed by the ventral extension of the alinasal cartilage; *s.n'.*, triangular depressed area formed by the ventral edge of the septum nasi where it descends t become intercalated into the nasal floor.

Fig. 12. Left lateral aspect of Model iii. The interrupted character of th cartilaginous boundary of the anterior narial aperture is apparent. Th posterior aperture-cartilage (*c.ap.p.*) is continuous behind and internall with the alinasal, and just behind this attachment the alinasal is continue backwards for some distance as a tapering conical cartilage visible in fig. (*c.p.*), but hidden here under cover of the premaxillary splint, *px″*. Othe letters as elsewhere.

Plate xl.

Figs. 13-21 represent a series of coronal sections through the region of th snout of the younger fœtal Ornithorhynchus. They may be collated with th figures of Model i.

Fig. 13 represents the 20th section of the series, the os carunculæ having first appeared in the 12th section. The section cuts the tips of the rostral prolongations of the marginal expansions of the great plate of cartilage which behind forms the nasal floor. The prerostral notch lies between the tips of the cartilages.

In fig. 14 the premaxillary trabeculæ continuous above with the os carunculæ are passing ventrally through the prerostral notch to join the rest of the premaxillæ.

In fig. 15 we reach the plane of continuity of the median septal bar (*s.n.*) and the cartilage of the nasal floor, the section passing just in front of the septal fenestra. The os carunculæ is now tapering away posteriorly. In figs. 14-16 the epidermis over the caruncle is somewhat thickened, though not excessively. It is stained yellow by the picric acid which was used as a counter-stain with the hæmatoxylin. A study of sections in front of those here figured shows that the cornification is most intense in the epidermal layers which correspond to the stratum lucidum.

Fig. 16 passes through the plane of the anterior nares and the septal cartilaginous fenestra. Here we can distinguish dorsal and ventral lamellæ of the body of the premaxilla as well as the true palatine processes.

Fig. 17 passes behind the cartilaginous septal fenestra, and shows the continuity of the wide ventral portion of the septum nasi with the cartilage of the nasal floor. The section is slightly in front of *s.n.* in fig. 3. The upper and lower valvular folds are here cut across.

Fig. 18 is a little in front of the plane of the partial coronal section of Model i., seen in fig. 3 in the right side of the figure. The anterior end of the cartilaginous capsule of Jacobson's organ is cut across. The marginal expansions of the nasal floor cartilage are now no longer continuous medially with the alinasal.

Fig. 19 is practically in the plane marked by *n.p.c.* in fig. 3. It passes duct of Jacobson's organ. The neuro-epithelium of the latter is well shown (*J.o.e.*).

Plate xli.

Fig. 20 represents a coronal section at about the plane of the posterior margin of the lamella marked *s.p.c.* in fig. 3. It passes through the internasal aperture (*i.a.*) below the septum nasi, and shows the now tapering posterior ends of Jacobson's cartilages.

Fig. 21 is immediately behind the plane of the internasal aperture; the tip of Jacobson's cartilage on one side is still present, whilst the vomer has appeared as a splint on the ventral border of the cartilaginous septum nasi. Instead of the cartilaginous lamella (*s.p.c.*) seen in fig. 20, we now have, as skeletal basis of the secondary palate, the palatine plates of the maxillæ (*mx′.*). Note here, as well as on one side of the previous figure, the compact bundle of nerve-fibres from the olfactory bulb passing towards the hinder extremity of Jacobson's organ to supply its neuro-epithelium.

Plate xlii.

Fig. 22. Portion of coronal section of snout of specimen "A" of fœta Ornithorhynchus. Section No. 23, of series. Hæmatoxylin and picric acid staining. Magnification of 100 diameters. The most dorsal portion of the os carunculæ exhibits an area of apparently cartilaginous character. Its cells are larger, vesicular, and have very distinct capsules around them.

General list of reference letters,

al.n., alinasal; *al.n′.*, free anterior margin of alinasal; *al.n.f.*, alinasal forming nasal floor; *al.n.t.*, alinasal turbinal; *ant.nar.*, anterior nares; *c.ap.*, cartilage of narial aperture; *c.ap.a.*, cartilage of narial aperture, anterior moiety; *c.ap.p.*, cartilage of narial aperture, posterior moiety; *fen.*, fenestra of cartilaginous septum nasi; *gl.*, glandular tissue; *i.a.*, internasal aperture above secondary palate; *J.c.*, cartilaginous capsule of Jacobson's organ; *f.J.c.*, foramen in cartilaginous capsule of Jacobson's organ; *J.o.e.*, epithelium of Jacobson's organ; *J.ol.*, olfactory nerve-bundle for Jacobson's organ; *m.c.*, marginal cartilage of snout, expansion from nasal floor cartilage; *r.m.c.*, rostral continuation of above by side of prerostral notch; *mx.*, maxilla; *mx′.*. palatine plate of maxilla; *n.*, nasal bone; *n.n.*, nasal nerve; *n.d.*, nasal duct; *n.f.*, nasal floor; *n.v.*, narial valves; *n.p.c.*, naso-palatine canal; *o.c.*, os carunculæ; *pr.n.*, prerostral notch; *p.p.c.*, cartilage of papilla palatina; *p.vo.*, prevomer (dumb-bell ossification); *px.*, ventral lamella of body of premaxilla; *px′.*, trabecula connecting os carunculæ with rest of premaxilla; *px″.*, dorsal lamella of body of premaxilla; *p.px.*, palatine process of premaxilla; *s.n.*, septum nasi; *s.n′.*, septum nasi where it descends into the floor of the mouth; *s.p.c.*, cartilaginous lamina forming skeleton of anterior part of secondary palate; *st.c.car.*, cornified strata of epidermis covering caruncle; *T.*, tongue; *vo.*, vomer.

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ADDENDUM.

Since the above paper was read I have received through the courtesy of Dr. J. F. van Bemmelen, a copy of his recently published contribution to Semon's Zoologische Forschungsreisen in Australien, &c., on the subject of the Monotreme skull (der Schädelbau der Monotremen). The author deals at some length with both adult, immature adult, and young conditions of the snout skeleton, summarising and discussing the views of previous writers. He adopts the designation of praevomer for the dumb-bell-shaped bone, and defends the vomerine theory of its homology from certain recent criticisms of Gegenbaur, which would seem to rest on a misconception. The paper is a comprehensive one, and may be consulted in connection with the present publication, although dealing with substantially older stages than those I have been privileged to work with.

NOTES AND EXHIBITS.

Mr. D. G. Stead exhibited a beautiful Sand-Eel from Cowa Bay, Hawkesbury River; several specimens of two species o *Locustidæ*, and two Geckos from Tanna, New Hebrides; specimen of *Ceratothoa*, a crustacean parasitic chiefly in the mouths of th Yellowtail (*Trachurus*); and the larvæ of a common moth, *Agarist glycine*, Lewin, which at present are doing great damage to th young grapes in the vicinity of Sydney.

Mr. Steel exhibited a very fine collection of beautifully preserved specimens of different species of *Peripatus* from the various Australasian Colonies, South Africa and Chili.

Mr. Froggatt exhibited specimens of a ladybird beetle, *Cryptolaemus Moutrouzieri*, Muls., the larvæ of which have been very numerous for the last month on the Norfolk Island and Bunya Pines all round Sydney, feeding upon a scale, *Dactylopius aurilunatus*, Mask., which if it were not thus kept in check would cause considerable damage to the trees. As the larvæ after feeding upon the scale cover themselves with the remains of the scale insects, they give the bark of the trees the appearance of being covered with lime-spots. This leads to their being destroyed under the impression that they are scale insects.

Mr. Froggatt also showed cultures of a fungus, *Sporotrichium globuliferum*, Spey, which has been largely used in America to destroy the Chinch Bug (*Blissis leucopterus*). As this pest is closely allied to the Australian Rutherglen Bug (*Nysius vinitor*), it is proposed to experiment upon the latter with the fungus.

Mr. W. S. Dun exhibited, from the Geological Survey Museum, a specimen of shale from the Sydney Harbour Colliery shaft at Balmain obtained at a depth of 2870 feet. The specimen shows several examples of a *Schizoneura* (possibly *S.* (?) *australis*, Eth. fil.), closely allied to the Indian *S. gondwanensis*, Feistm.; on the same slab is a frond of *Glossopteris browniana*. This association is of great interest in regard to the Australian range of the species. The unique type specimen of *S.* (?) *australis* was collected from the roof of the Bulli seam. In India the genus occurs in the Damuda and Panchet divisions of the Lower Gondwanas associated with *Phyllotheca*, *Glossopteris*, *Gangamopteris*, *Sphenopteris*, *Noeggerathiopsis*, *Alethopteris*, *Macrotæniopteris*, *Angiopteridium*, *Sagenopteris* and numerous other forms. In the Argentine *Schizoneura* is associated with an Upper Gondwana Flora which contains such Australian Mesozoic types as *Thinnfeldia odontopteroides* and *Zeugophyllites elongatus*.

Mr. North reported that among migratory species of birds now breeding at Roseville, were *Eurystomus pacificus*, *Myiagra rubecula*, *Gerygone albigularis*, *Myzomela sanguinolenta*, *Lalage tricolor*, and *Edoliisoma tenuirostre;* the last of these had been noted for the past two seasons at Roseville, and at Waterfall in 1897-8. During the month Mr. George Savidge had taken the egg of *Cacomantis variolosus* from the nest of *Eopsaltria capito*, and on the 23rd inst. Mr. North had taken the same species of Cuckoo's egg from the nest of *Rhipidura rufifrons;* also the egg of the Bronze Cuckoo, *Lamprococcyx plagosus*, from the nest of *Gerygone fusca*. At Ourimbah he also noted a pair of *Monarcha gouldi*; and a small flock of *Donacicola castaneothorax*. Both species are common on the northern coastal rivers, but this locality is the farthest south he has known them to be found.

WEDNESDAY, MARCH 26TH, 1902.

The Twenty-Seventh Annual General Meeting of the Socie was held in the Linnean Hall, 23 Ithaca Road, Elizabeth B on Wednesday evening, March 26th, 1902.

Mr. J. H. Maiden, F.L.S., &c., President, in the Chair.

The Minutes of the previous Annual General Meeting we read and confirmed.

The President delivered the Annual Address.

PRESIDENTIAL ADDRESS.

(Plate xliii.)

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INTRODUCTORY.

On the occasion of the Twenty-seventh Annual General Meeting one is gratified to be able to report that during the past year the Society has fully maintained its activity.

Fourteen Ordinary Members and one Corresponding Member were elected; one Ordinary Member and one Associate Member resigned; and one Ordinary and one Corresponding Member died.

Dr. Charles Dagnall Clark practised his profession for a number of years at North Sydney, and died on 5th June last in the midst of his work, aged 45 years. He was an enthusiastic entomologist, especially interested in Lepidoptera, who became a Member of the Society in July, 1899. Among his professional brethren as in private life Dr. Clark was held in the highest esteem.

By the death of Professor Ralph Tate, F.L.S., F.G.S., on 20th September, 1901, the Society lost one of its oldest Corresponding Members. His first contribution to the Society's Proceedings is to be found in the second Volume (p. 290: read December, 1877). His last to the Society as well as to Science—"The Revised Census of the Marine Mollusca of Tasmania," prepared in collaboration with Mr. W. L. May, of Hobart—forms Part iii. of the Proceedings for 1901 recently issued; and was passing through the press at the time of his death. Professor Tate came out to Australia in 1875 as the first occupant of the

Elder Chair of Natural Science in the University of Adelaide; and thereafter actively laboured to advance a knowledge of the flora, fauna and geology, primarily of South Australia, but as leading up to the consideration of questions of an Australian or Australasian character. In addition to an extensive series of papers comprised in the twenty-five published volumes of the Transactions of the Royal Society of South Australia, Professor Tate also contributed others, at some time or other, to almost every scientific Society in Australia. Special mention may be made of his Presidential Address to the Biological Section of the Australian Association for the Advancement of Science, at the first Sydney Meeting of 1888, in which he proposed a threefold division of the endemic Australian Flora according to subregions. Also of his Presidential Address to the Association at the Adelaide Meeting of 1893, in which he treated of a Century's Geological Progress in Australia. Professor Tate was a member of the Horn Scientific Expedition to Central Australia in 1894; and an important contributor to the botanical, conchological and geological sections of the published results of that great undertaking. He was also the author of a "Handbook of the Flora of Extratropical South Australia," published in 1890. In a word, Professor Tate was a most worthy South Australian representative of the biological and geological veterans of the older States, whose numbers during the last decade or two have, in the ordinary course of nature, so sadly diminished.

In the early part of the year Mr. Cecil W. Darley, Mem. Inst. C.E., found it necessary to retire from the Council in consequence of his removal from Sydney to London. Apart from personal and professional qualifications Mr. Darley's wide experience and extensive knowledge in matters Australian, made him a very valuable member, and his resignation was received with much regret. Mr. James P. Hill, B.Sc., F.L.S., Sydney University, was elected to fill the vacancy.

In September last, to the regret of the Council, Mr. P. N. Trebeck found it necessary to resign the Hon. Treasurership, in consequence of his retirement from active business life. The

Council took an early opportunity of placing on record its appreciation of Mr. Trebeck's services to the Society as Hon. Treasurer during a period of nearly four years. Mr. J. R. Garland, M.A., was elected to succeed Mr. Trebeck, and assumed office on 5th September, 1901.

The names of the President, six Members of the Council, including the President, who this year retire in accordance with the Rules—namely, Professor David, Messrs. Deane, Garland, Hill, Maiden and Trebeck, and of the two Auditors—Messrs. Carson and Palmer,—but who are eligible for re-election, have already been communicated to you by circular.

Thirty-eight papers contributed during the year were accepted for publication. These have already been published and delivered, or are now in type. The 100th consecutively issued Part of the Proceedings, with twenty-one plates, completing Vol. xxv., was completed and distributed as far as possible on 20th May, 1901. Though no effort whatever was made to make this particular Part a special one, it will be conceded that its varied contents very creditably signalise the Century Number of the Proceedings. In addition to this Part, three Parts of the Proceedings for 1901 were issued before the close of the year, Part 3 being given up entirely to "The Revised Census of the Marine Mollusca of Tasmania," by the late Professor Tate and Mr. W. L. May.

When completed it will be found that both in regard to the importance of the papers and to the illustrations, last year's Volume will take a good place in the now steadily growing series which the Society's publications make up.

With the acquisition of the late Sir William Macleay's legacy for the endowment of Bacteriological research, the Society, as an educational agency, entered upon a new phase of usefulness which has already had time to begin to bear visible fruit. During the three years (1899-1901) in which the Bacteriological Laboratory has been in working order, three pupils have received one or more courses of laboratory instruction—one in 1899; two in 1900, one of whom came from Adelaide for the purpose; and one in 1901. The three Volumes of the Society's Proceedings for the years mentioned contain the Bacteriologist's contributions to knowledge. These are not merely scientific papers published by the Society, but they are also the results of investigations carried out under the Society's auspices. These contributions now give Bacteriology a distinct *locus standi* in the Annual Volume. The work of Mr. Greig Smith, the Macleay Bacteriologist, during 1901, is referred to later on (p. 751).

1. SOME BOTANICAL REMINISCENCES OF THIS SOCIETY.

In the very early days of its existence this Society was practically a zoological Society. In his second Presidential Address, delivered in January, 1876, Sir William Macleay remarked that it seemed to be rather anomalous that a Society named after the illustrious Linnæus should not have apparently a single working botanist among its members. But a little consideration will show that at this time Australian botanists, with the exception of Baron von Mueller, were merely undergoing a period of latency, pending the completion of the *Flora Australiensis*, the seventh and concluding volume of which did not make its appearance until the year 1878. Meanwhile, as long as this great work was in progress, it is obvious that Australian would-be working botanists could best advance the interests of science by assiduously collecting and sending their collections to Melbourne for consideration by Mr. Bentham and his collaborator, Baron von Mueller, rather than by attempting to deal with them themselves. Moreover, at this time, too, there was the prospect of a Supplementary Volume to be drawn up by Mr. Bentham; though eventually this was not carried out. There was, therefore, every reason why local botanists should stay their hands pending the conclusion of the great English systematist's labours. But in our time the pendulum has swung back. Instead of the botanical proceedings of this Society being confined to an exhibit or two, with an occasional paper, there is now no lack of interest in the botanical portion of the programme a circumstance which continues to bode well for the advancement of this branch of science in New South Wales.

The first botanical paper to be met with in the Proceedings is a popular account of the Flora of Northern Queensland, by Mr. F. M. Bailey, which appeared in the second Volume (p. 276). A popular paper "On the Ferns of Queensland," from the same pen, appeared in the next Volume (p. 118). Another popular paper on the introduced Plants of Queensland will be found at p. 26 of the fourth Volume; and the first descriptive botanical paper, also by Mr. Bailey, "On a new Species of Fern, *Asplenium Prenticei*," at p. 36 of the same Volume. In the same Volume also the Rev. Tenison-Woods and Mr. Bailey write on the Brisbane Flora. In the fifth Volume the indefatigable Bailey has a paper on the "Medicinal Plants of Queensland," and another on two new Queensland Ferns. Tenison-Woods and Bailey write on the Fungi of New South Wales and Queensland; and the latter describes a new species of *Nepenthes*. In the fifth Volume also Baron von Mueller makes his début (p. 286) with Notes on the Flora of Mt. Dromedary; and this is followed (at p. 288) by Rev. Dr. Woolls' maiden paper on the "Eucalypts of the County of Cumberland." To the sixth Volume both Mr. O'Shanesy and Rev. B. Scortechini were contributors, so that by this time, under the influence of a completed *Flora Australiensis*, the ship of botany might be said to be now fairly launched. It will be seen what a prominent part Bailey took in the botanical work of our infant Society.

I knew the late Rev. Dr. Woolls well, and useful as some papers read before this Society are, I always feel that they do not do full justice to his botanical knowledge, on account of his great diffidence in expressing his opinions. He would freely and fully place his stores of information at the disposal of others, but rarely could he be persuaded to appear in print. He seldom, if ever, published a new species, although to others (almost invariably to Mueller), he would indicate what he deemed to be new and would leave the credit of publication to others. Mr. E. Haviland was another of the early botanical contributors to our Proceedings. He is still alive, though feeble from great age, and, like Woolls, he was very adverse to see his name in print. Though a good systematist as regards Port Jackson plants, morphology and physiology were his forte. For years he and I spent our Saturdays together on botanical excursions, and I owe much to the fatherly way in which he imparted instruction. An instance of his diffidence in presenting statements is his reference to the stigma in *Boronia pinnata*,* Sm., in which he clearly indicated the rediscovery of Sieber's *B. floribunda*, which Mueller did not agree to until several years later.†

Woolls and Haviland were the two New South Wales botanists to whom our Society in its early days owed most, and their personal influence upon young members a decade and a half and more ago will long be felt with gratitude. Although not a botanist, the founder of this Society, the late Sir William Macleay, will ever be affectionately remembered by the older botanical members. He used to organise all-day Saturday excursions to interesting localities, always bearing in mind the wishes of botanists; and if the places were difficult of access, the cost of conveyance would be generously defrayed by himself, and usually he would insist on bringing a well-stocked hamper of provisions. He used to take great interest in our work, asking many questions, and when we made a find he was as happy as we were.

2.—CALEY AND LEWIN.

I have recently been fortunate enough to find, in the Vienna herbarium, a number of Caley's Eucalypts bearing dates between the years 1805 and 1810, in most cases with the aboriginal names in Caley's handwriting. Of 55 specimens 54 are determinable. Robert Brown says‡:—"Mr. Caley has observed within the limits of the colony of Port Jackson nearly 50 species of Eucalyptus, most of which are distinguished, and have proper names applied to them, by the native inhabitants, who from differences in the colour, texture, and scaling of the bark, and in the ramification and general appearance of these trees, more readily distinguish them than botanists have as yet been able to do." I do not doubt that the names on the Vienna specimens are some of those referred to by Brown, and it is my intention to shortly publish them with their botanical equivalents, and some notes on Caley's career, in the *Agricultural Gazette* of New South Wales.

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* These Proceedings, vii., 397, 1882.

† 2nd Census Aust. Plants, p. 18, 1889; these Proceedings, xxi. p. 503, 1896

‡ *Collected Works*, Ray Society, i., p. 18.

Through the kindness of the Hon. Phillip Gidley King, M.L.C., grandson of Governor King, I have been enabled to critically examine his fine collection of coloured drawings of New South Wales plants executed by I. W. Lewin from about 1805 to 1808 for Governor and Mrs. King. Little is known of Lewin, but he was of course a contemporary of Caley, and doubtless obtained some botanical assistance from the latter. They were shipmates on at least one occasion. Most of the drawings are of the indigenous vegetation of Port Jackson; a few are of weeds and other introduced plants. Botanical dissections are given in a number of instances. I have Mr. King's permission to publish my determinations, which I hope to do shortly. Besides these, Mr. King has two beautiful paintings by Lewin, really artistic productions. Both are on parchment (perhaps old drum-heads), each measuring 21 x 18 inches without the frames. One is the Waratah (*Telopea speciosissima*), and is signed "I. W. Lewin, Nov. 20th, 1805, New South Wales." The other is the Gigantic Lily (*Doryanthes excelsa*), and is signed "I. W. Lewin, A.L.S., New South Wales, June 19th, 1808." Surely we may include Lewin amongst the small band of those who diffused a knowledge of our flora during the early years of the nineteenth century. If he depicted a bird on a tree, a twig was usually so carefully drawn that the tree may be botanically determined. It is hoped that no efforts will be spared to collect all that is known of the work of this—the first Australian scientific artist. Following is information in regard to Lewin taken from the "Historical Records of New South Wales":—

Vol. iii., 358. The Duke of Portland writes to Governor Hunter, under date 6th February, 1798—"Mr. Lewin is a painter and drawer in Natural History, and being desirous of pursui his studies in a country which cannot fail to improve that bran of knowledge,* you will allow him the usual Government ratio during his residence in the settlement."

Vol. iv., 308. Governor King to Lieutenant Grant, 5th Marc 1801, instructing him to receive Caley on board the Brig con manded by the latter for the purpose of exploring the south-eas coast. He adds—"I have also allowed Mr. Lewin to embark o board the Bee, for the purpose of collecting, to whom you wi also afford such occasional assistance as may be in your power. (See also p. 356.)

Vol. iv., 417. Surgeon Harris to Governor King, fro Hunter's River, 25th June, 1801. "Mr. Lewin also says he ha met with new birds."

Vol. iv., 450, 451. Lieutenant-Colonel Paterson in his journa at Hunter's River speaks, under dates June 29th and July (1801), of being accompanied by Mr. Lewin.

Vol. vi., 305. Deputy-Commissary Fitz writes to Under Secretary Chapman, under date 15th October, 1807—"Lewin the naturalist, is now collecting a box of seeds of the plants, etc. of the country, which I shall send to you by the earliest convey ance."

These extracts also show that Lewin was of some standing i the infant community.

Incidentally I may mention that the labels of the herbariu specimens of the early collectors, and the notes on sketches, etc. contain an imperfectly explored mine of information in regard to the movements of such collectors, the aboriginal and othe vernacular names of plants, and of old place-names. To give but one example the Editor of the *Historical Records* (N.S.W.), vi. 188, hazards the opinion that Caley was in Sydney as late as the spring of 1808. I have a specimen collected by him as late as 5th February, 1810.

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* Cf. note by J. J. Fletcher, Rept. *Austr. Ass. Adv. Science* (Melbourne, 1900), p. 8.

3.—SOME BOTANICAL MATTERS OF LOCAL INTEREST.

The starting of the International Scientific Catalogue in London last year will, as time rolls on, be of increasing interest to us in Australia. The Royal Society of New South Wales has undertaken the functions of a Regional Bureau, and a large number of slips have already been sent to London. As regards botanical matters, nearly the whole of the slips sent were of papers contributed to the Linnean Society of New South Wales.

The establishment of a new series of the *Botanisches Centralblatt* as the official organ of the International Association of Botanists became an accomplished fact at the new year, and a valuable and improved record or précis of work in all branches of botany is available to votaries of the science.

An important outcome of the International Congress of Botany held at the Paris Exhibition in 1900, and which I had the honour of attending, has been the appointment of an International Commission for the purpose of preparing resolutions and papers with a view to the unification of the principles regulating botanical nomenclature. I have been appointed a member of this Commission, and will in due course inform members of this Society of the steps that are proposed to be taken with the view to the settlement of this vexed question. The second meeting of the Congress will take place in Vienna in 1905.

During my term of office Mr. James Britten, of the Department of Botany of the British Museum, has placed us under great obligation by the publication of Part ii. of the "Illustrations of the Botany of Captain Cook's Voyage round the world on H.M.S. Endeavour in 1768-71." The plates are Nos. 101-243, and the originals were drawn under the direction of Banks and Solander. Apart from the special Australian value of this classic, the work is of interest to botanists everywhere, in that it depicts a number of plants not hitherto illustrated. Personally I wish that Mr. Britten could have adopted a different nomenclature in many instances, especially as I doubt whether some of the changes he has sanctioned will ever receive general endorsement in this continent. But this is really a minor matter, and should not diminish our indebtedness to the Trustees of the British Museum, and to Mr. Britten for the service they have done in making these illustrations available to us.

The appearance of an important work by Webber on the fecundation of *Zamia** is of special interest to us in a country where *Cycadeæ* are so well developed. Spermatogenesis in plants (*Cycadeæ* and *Gingko*) was only announced in 1896 by the Japanese botanists Hirase and Ikeno, and Dr. Webber's work, begun in 1897, is rich in original matter, and contains a valuable bibliography. I do not doubt that our Australian physiologists will find his research full of inspiration.

The most serious loss to Australian botanical science during the year has been the death of Professor Ralph Tate of Adelaide, to whose life-work I have already alluded. He was one of the race of all-round naturalists, and achieved distinction in several branches of science. In botany he was a brilliant systematist of the conservative school, and Australian botany would have been richer but for the claims of other sciences on his time. His crisp dogmatism commanded attention, and if his statements appeared sometimes bold at first, they always secured respect, as his wide knowledge was willingly recognised. Personally I mourn a loyal friend and co-worker with whom I have been associated for many years, and I trust that his fine herbarium will be sacredly preserved, and that a South Australian will arise to continue his investigations on the flora of that State.

The Nestor of Australian botanists, Mr. F. M. Bailey, Government Botanist of Queensland, displays no flagging of his powers. During the year he has issued Part iv. of his excellent "Queensland Flora," including the orders *Hygrophyllaceæ* to *Eleagnaceæ*.

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* "Spermatogenesis and Fecundation of *Zamia*," by Herbert J. Webber. Bulletin No. 2 Bureau of Plant Industry, U.S. Dept. of Agriculture. (Issued December 28, 1901.)

This work does not prevent the publication of occasional papers on Queensland and New Guinea plants (sometimes describing new species) in the columns of the *Queensland Agricultural Journal*, and those who know the genial old veteran wish him still many years of useful service in making better known the marvellous botanical wealth of the northern State.

Mr. J. G. Luehmann, Curator of the National Herbarium of Victoria, is hard at work arranging the supplementary collections in that fine herbarium—solid, useful work that leaves him but little time for original research.

The Hobart Meeting of the Australasian Association for the Advancement of Science, held in January last, was not as botanical as usual, and were it not for Members of our Society there would have been no botanical contributions at all. There was a good gathering of Australian botanists who returned laden with specimens from Tasmania.

In our own Proceedings Mr. R. H. Cambage has continued his useful "Notes on the Botany of the Interior of New South Wales"; Mr. Watts has some records of Richmond River Hepatics; and Mr. D. McAlpine, of Melbourne, has a paper on the "Shot-hole Fungi of Stone-fruit." The Macleay Bacteriologist (Mr. R. Greig Smith) has contributed papers upon "The nature of the Bacteroids of the Leguminous Nodule and the Culture of *Rhizobium leguminosarum*," upon *Vibrio denitrificans*, and upon "Bacteria and the Disintegration of Cement." In the last paper it is shown that the decay occurring in the cement work of water canals and reservoirs cannot be traced, as has been suggested, to the action of certain bacteria, but to the chemical and physical action of the water upon inferior cement. In "The Gum Fermentation of Sugar-cane Juice" he described the isolation of *Bacillus levaniformans*, n.sp., which, in the manufacture and refining of cane sugar, causes a direct loss by the formation of gum, and an indirect loss by the gum retarding the crystallisation. The loss does not stop there, for the bacillus inverts the sugar in the juice, and also continues the degradation in the crystals after manufacture during storage and transit, as has been shown in

"The Deterioration of Raw and Refined Sugar Crystals in Bulk The bacillus may also cause "The Acid Fermentation of Ra Sugar Crystals." The bacillus was found in sugar from wide distant lands, from beet as well as from cane sugar; and th Society is to be congratulated upon the fact that this univers and important agent, which entails so great a loss to a hug industry, has been discovered and investigated in its laborator Mr. Greig Smith is doing excellent work, and is justifying th sagacity of our founder who provided the means by which suc researches are possible under the auspices of the Society.

4.—The Forestry Question in New South Wales.

A few months ago I delivered a lecture before our Roya Society on the "Forests of New South Wales,"* in which I gav some *facts* in regard to the trees and timber of this State. now propose to follow up these facts with some *opinions* in regar to local forestry matters worth consideration. Although I hav given attention to Australian forestry for many years, I hav neither occult nor heroic remedies to apply at the present time, but every friend of the Forest Department will admit that its usefulness can be enhanced. First of all let us take stock of our forest reserves. Let them be accurately defined, and let those areas be rejected that are not required. It should be recognised that our country contains a large proportion of land unsuited t agricultural purposes;† much of this is available for forestry operations. It therefore seems equitable that the land suitable for crops and good pasture should, if held at all by a Forest Department, be held only until required for purposes of settlement.

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* *Agricultural Gazette of New South Wales*, July, 1901.

† As regards land actually utilised at present for agricultural purposes see Coghlan, *Statistical Register* (1901), Part ix., Agriculture, &c. See figures in regard to areas cultivated under artificial grasses, under crops, &c The grazing lands (ringbarked and non ringbarked, and natural pastures would be difficult to compute, except very approximately.

It has been decided to classify our forests, but no method will be satisfactory that is not based on the ecological principles referred to below at p. 776. We have not, however, full data at present to make a final classification of our forests; these will be secured as our botanical survey is pushed on.

I understand that the classification of the timber-bearing lands, so as to define their relative values for growth of timber and for agricultural purposes, has been proceeding, under the auspices of the Forest Department, for the past three years, and is to a large extent completed. To finish this work, and to settle the differences of opinion existing in many special instances between the Lands and Forest officials, will be the task, I understand, of the Commission of Experts that the Minister for Forests (Hon. Walter Bennett) has stated, in the press, it is his intention to appoint.

Then I would enunciate the axiom that we require to take stock of the trees upon the national property. What kinds have we? Where are they? Where do they flourish best? What is their state of maturity? For what purposes are the trees best suited? Can we answer all these questions? I fear not, and until we can do so much better than at present, I am afraid that our dealings with our forests will be based on empiricism. We ought to be in a position to inform an interested enquirer, at short notice, in what part of the country there is to be found timber best adapted for a certain purpose, and in what approximate quantity. Until we get this survey, which need not be minute, of our resources, I am afraid we shall not have a Forest Department which will command the full confidence of the country.

To avoid tedious reiteration, may I, at this place, be pardoned if I refer to some remarks addressed by me to our Royal Society in 1897;* I do not intend to repeat them.

This botanical survey of which I have spoken, will lead, by the quickest road, to an accurate knowledge of the properties of our timbers. There is no stimulus to enquiry more keen than that of pecuniary interest, and the commercial man will ascertain the value of a timber for his own purposes if he be given an opportunity. For all commercial purposes there must be (1) a sufficiency of the article; (2) continuity of supply. How can a man be assured of this except by a botanical survey? He sees a piece of timber and says—"This will do admirably for a certain purpose," or "If I had a large supply of this timber, I could utilise it at once." These statements have been made to me hundreds of times by Australians, and by visitors anxious to do business with us, but they have often been stopped at the threshold by my inability to answer the pertinent questions to which I have referred. I therefore would put the botanical survey (or whatever name one may choose to call it) amongst the very first of the duties to be undertaken by a Forest Department. Examination of our timbers can go steadily on even before a survey is made, but such examination must be fitful and incomplete until it receives the stimulus of the attention of users of timber and other commercial men actuated by self-interest. It is not for me who have, perhaps, been longer engaged in critical investigations concerning the identification, properties, and uses of our timbers than any other public servant in New South Wales, to depreciate scientific research, but I have experience of the many limitations of the scientific and technological investigator.

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* Journ. R. Soc. N. S. Wales, xxxi., 62, 67, 68.

This country requires *conservation* of forests rather than plantations. It should be ascertained in what forest reserves young trees can be economically conserved, and reserves open to the timber-getter should be carefully cut over and then closed, if necessary, for a term of years. In European countries conservation, as opposed to planting, is more actively carried on than is usually supposed.

Intimately associated with the question of conservation is the necessity for the imposition of judicious limitations upon the ringbarker,—he who performs the operation recklessly, and in a wholesale manner, solely in the pastoral interest.

I would protect the forests at the heads of water-courses and in broken country generally. Much country of that character is of no use for agriculture, and its dedication for forestry purposes would not excite the cupidity of persons in search of land.

I have already hinted that planting as a source of timber should not be undertaken on a large scale in New South Wales. The initial cost of careful planting and protection of the young plants can only be justified in exceptional circumstances. Some well-meaning friends would urge us to establish plantations of soft-woods, *e g.*, the Pines of the Baltic and North America, the Redwood of California, and so on, but our climatic conditions are so different to their native countries, that we cannot hope to compete commercially in the production of such timbers. Ours is a country that naturally produces hardwood, and it seems to me that we should promote the growth of the best of those, and rely upon the competition of trade to supply us with soft-woods in exchange. Of course, if expenditure of money be no object, we can establish plantations of soft-woods, but to secure this we may require to utilise land adapted to agricultural purposes, and to expend funds on nursing plants for which the commercial returns will be altogether inadequate. In a country such as ours, in which the functions of government are so extensive, it is sometimes desirable to ask oneself the question, "Would I incur this expenditure on private account?" I am referring now to the question of the cultivation of soft-woods. But I would certainly make experimental plantations of Silky Oak (*Grevillea robusta*) in some of the drier districts which experience has already shown suitable to it, and the Red Cedar (*Cedrela australis*) should be judiciously re-planted in country from which it has been well-nigh exterminated.

Of far greater importance than actual planting operations by the Forest Department would be the education of our citizens in tree-planting. It must be remembered that our people are not a race of tree-planters, and many of them to whom trees would be of the greatest advantage for shade, shelter belts and other purposes, have no intelligent idea of planting. Hence they was money and time and then draw conclusions that it is useless proceed further. We have many difficulties in regard to o climate, but some are surmountable by properly directed energ I am of opinion that practical demonstrations in the countr districts by skilled tree-planters from the Forestry Departme on "How and when to plant a tree and how to care for it whe planted," would be the means of causing trees to be planted whe they are most wanted, and where they would be most cared fo Such plantations would neither be a source of anxiety nor expen to the State, though of great advantage to her citizens.

The planting of trees in the Western plains is a question th must receive serious attention at an early date. It is one th should be undertaken or supervised by the Forestry Departmen a sub-branch of which should be responsible for plantations i the arid west, the conditions being special. The object of tre growing in such districts is not entirely for conversion int timber—perhaps such an object is a subordinate one—but a ver important result would be the amelioration of the condition the residents in that trying climate. That being so, success i not to be measured by the Treasury receipts from such forest As I believe that the desirability of tree planting in the Wester plains is not open to question, I have only to add that, in m opinion, the work should be carried on from local State nurserie which should be attached to the existing Experiment farms a Coolabah, Pera Bore (Bourke), and Moree. I would also have nursery at, say, Hay. In this way the trees would be grow under conditions approximating to those they would have to gro in. At present plants for the arid West are raised in nurserie in the coast belt, with an annual rainfall of from 30 to 50 inches besides which they have to travel hundreds of miles to thei destination. The results are frequently disastrous as far as th establishment of sturdy trees is concerned; it would be a matte for surprise if it were otherwise.

If one's knowledge of Australian forestry were confined t what one sees in letters to the newspapers, one would imagine that its sole object is the furnishing of timber to the saw-miller. That is but one object, albeit an important one, other phases of forestry being the combating of drift sand (alluded to below), planting for the mitigation of floods, the up-keep of river banks, the planting of shelter-belts, and so on. The forester has as much right to claim credit in the national balance sheet for improvements such as these as from the revenue arising from timber royalties. The recently published Report of the Western Lands Commission has vividly brought home to us the fact that dealing with sand-drifts is not a coastal question confined to Sydney and Newcastle, but one of magnitude to the far West, and one that must be coped with in the near future unless we are prepared to abandon large areas of pastoral country. The question of dealing with drift sand belongs properly to a Forest Department, and it is of such great local importance to both east and west of our State that I would not continue to leave it be dealt with in a desultory manner, but would make a sub-branch of the Forestry Department responsible for this service.

It has been suggested that, as soon as possible, a highly trained forester from Europe or India should be appointed to take charge of our forests. My own view of this suggestion is that it is a plausible one, but that it should not be looked upon as a panacea for what is admittedly an unsatisfactory state of affairs. In the first place, if we were to bring a man accustomed to treat forests with despotism tempered by benevolence into New South Wales, which possesses one of the most democratic governments in the world, and which spirit of government has been largely applied to our forests, what would be a foregone conclusion ? If he were a firm man he would come into collision with vested interests immediately; if he were a weak one, he would speedily lose heart in contemplation of the impossible task set him; in either case, in my opinion, the experiment would be doomed to failure. Then again, our forests are mainly those of Eucalypts, one of the most difficult groups of plants in the universe, and a stranger must be a few years before he can obtain a knowledge of them sufficiently intimate for the purposes of the conservator. My view, more than once expressed, is that our peculiar conditions necessitate the setting up of a specially adapted system of Australian forestry, for I know of no country whose methods can safely be transplanted without much alteration. Of course the personal equation in forestry is an important one—there may be a man whose experience and whose personality would enable him to successfully deal with our forest questions from the start, but he has to be found. I think we should first set our house in order, obtain a temperate Forest Act, the passing of which can only be secured by a spirit of compromise, obtain knowledge of our own forest lands and of the timbers upon them; all these things can be done with sufficient thoroughness in from three to five years, by which time I do not doubt that the Minister in charge of Forests will be able to offer the post of Acting Conservator to a man with special qualifications. We have made so many mistakes in the past in dealing with our forests that I venture, thus imperfectly, to outline a policy which I submit is sound, and which is certainly safe.

From my remarks it will be observed that my view of the operation and responsibilities of a Forest Department is that they have a much wider scope than is usually attributed to them.

There is no doubt whatever in my mind that an ideal arrangement would be the consolidation of all forestry work and interests in one compact department, under the administration of a sympathetic Minister of the Crown whose attention should be solely occupied with the welfare of this great national property, the forests of New South Wales, and the undertaking of the other important duties which I have indicated as coming within the purview of a modern forestry system.

As a public servant I have my limitations of speech, but I think it is my duty, as your President, and speaking as I do to a body of scientific men, many of whom have given much attention to phases of the forestry question, to ask you to strengthen the hands of the Government in their efforts to deal scientifically with a congeries of knotty scientific problems.

Owing to the enlightened policy of the Hon. William Patrick Crick, Minister for Lands, who first gave me authorization, and the Hon. Walter Bennett, Minister for Forestry, who has continued his support, I have made considerable headway with quarto illustrations of the forest flora of New South Wales. It is my desire to depict every tree in the State, and the beautiful illustrations from Miss Flockton's pencil can now be reproduced at a cheap rate as soon as it is desired to prepare the work for publication. Previous enterprises of this sort have resulted in financial failure through the cost of reproduction, an error I am determined shall not be repeated in the present case. Of this I am certain, that a work like this would give an impetus to the study of botany and forestry in this State, and also that the moderate sum expended upon it will receive the unanimous approval of all who are interested in diffusing a knowledge of the trees of New South Wales It will also convince the public that the Forest Department is now alive to a very obvious duty.

While glad of the opportunity of being able to carry out the work I have just indicated, I hope at the proper time to suggest the issue of another work of undoubted practical value. I refer to a book of photographic reproductions of the forests of New South Wales, depicting not only characteristic individual trees, but also typical forest scenes. The growth and variation of the same species in different localities and under different conditions could be shown, and if the subjects were carefully selected and judiciously described, such a work would be of immense value in advertising and creating an intelligent interest in our forest resources. Knowledge of our forests is possessed by a very small percentage of the community, and I am confident that suitable pictorial illustration would be a potent factor in dispersing that ignorance.

5.—Botanical Survey of New Souph Wales.

i. *A botanical map* (Plate xliii.).

a. Introductory.

Reverting (*supra*, p. 753) to my suggestion for a botanical survey, I may state that during the five years that have elapsed since those words were uttered, I have received not a few expressions of opinion from those who approve of the idea. Other duties have hitherto prevented me from making definite suggestions with the view of mapping out the State into botanical provinces, but what I now submit may be of service as a basis for work. It is impossible to construct a complete botanical map while there is so much botanically unexplored country, and what I have indicated is really a scheme for systematic botanical exploration.

Our State is divided into counties which, in many cases, have artificial boundaries. They will, however, be useful, to some extent, for the purpose of giving definiteness to some of our proposed botanical areas. New South Wales is also divided into three roughly parallel portions for the purpose of Land Administration, the boundaries being an attempt to define the lands in accordance with their climatic and settlement values. It is very difficult to divide New South Wales into natural physical divisions of any kind, as anyone who has made the attempt has readily discovered.

I have tried to divide the State into botanical districts on climatic data, but have found many difficulties. Mr. H. C. Russell, our Government Astronomer, has published maps showing, in square degrees, (1) the average rain, (2) the average monthly rainfall, (3) the spring, summer, autumn, and winter mean temperatures, and the highest and lowest temperatures, (4) the average temperature for each month in the year, but I have only been able, in a very general way, to use these data for botanical purposes.

The late Mr. R. D. Fitzgerald* made the first attempt with which I am acquainted to divide New South Wales in accordance with its botanical features. His classification is as follows, but, it will be observed, it is but slight.†

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* *Linn. Soc., Lond.* (1882): Abstract in *Journ. Bot.*, xx., 96.

† The paper of Prof. Ralph Tate "On the influence of physiographic changes in the distribution of life in Australia" (*Proc. Aust. Assoc. Adv. Sci.* i. 312, 1888), should be referred to. He discusses the flora of the whole of the continent, dividing it mainly into three groups and deals with general

1. That of the sandstone, or poor country, represented by the *Proteaceæ*, *Epacrideæ*, and *Xanthorrhœa*.
2. Eastern slopes of coast range represented by *Urticeæ* and *Palmeæ*.
3. Cold mountain lands represented by *Doryphora*, *Filices*, and *Myrtaceæ*.
4. Interior plains represented by *Chenopodiaceæ* and *Compositæ*.

I now proceed to lay before you a tentative scheme for the division of New South Wales into botanical "counties." It will be seen that various considerations have weighed with me in suggesting their limits. I do not doubt that my map, imperfect as it is, will give definiteness to criticism, and the eventual outcome will be that we shall have a botanical map of scientific and practical value.

I have used the term botanical "county" because a similar term has been used for somewhat similar botanical areas in Great Britain and Ireland. Most of the areas I have called counties are larger than the European ones. There is, however, the objection to this term, that it is liable to be confused with the political or municipal divisions called "counties." For a similar reason M. Flahault* substitutes "domaine" for the "province" of Engler. It is not likely that names for phytogeographic divisions will be generally agreed upon except as the result of an international conference. M. Flahault's paper* makes suggestions in regard to the nomenclature of botanical areas, as follows :—

GROUPE DE REGIONS.
    REGION (Martius 1831).
        DOMAINE.
            Secteur.
                DISTRICT (Bezirk, Engler, 1879).
                    SOUS-DISTRICT.
                        Station (Wimmer, 1844).

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* Projet de nomenclature phytogéographique. *Proc. Congr. Int. de Botanique*, Paris, 1900.

Examples of this classification are given as follows :—

Région.—(1) "Région forestière de l'Europe occidental."
(2) "Région mediterranéenne."

Domaine.—Région (1) "Un domaine atlantique, un domaine des plaines du Nord continental Européen, un domaine du centre de l'Europe."

Région (2) "Domaines ibérique, Mauritanien, français, etc."

Secteur.—The "Domain atlantique" includes "Un secteur *aquitanien*, où les espèces immigrées de la région Méditerranéenne sont nombreuses, et un secteur *armoricain* où elles manquent."

District.—"Dans le domaine français de la région méditerranéenne, *le district* calcaire des basses Corbières, *les districts* des maurès et de l'Esterel formé de roches éruptives siliceuses. Les Baléares, avec leurs nombreuses espèces endémiques, constituent un district très distinct dans le secteur occidental du domaine ibérique."

From this it is clearly seen that the grouping of land-areas even in Europe contains the elements of indefiniteness and of expediency; as our country becomes better known botanically we shall be able to define it better, but New South Wales will certainly be found to be more uniform in its vegetation (and therefore more difficult to split up into divisions), than western and central Europe. We have much of the continental climate and uniformity of Russia.

It will also be seen that the divisions "Domaine," "Secteur" and "District" are, in the present state of our knowledge, only of partial application to New South Wales, unless we attempt much subdivision. I feel more and more strongly that we have so much pioneering work to do in connection with our botanical survey that we cannot at present adhere very closely to European precedents in regard to the subdivision of botanical areas. C. B. Clarke[*] has divided British India into botanical areas. He says, "British India having been treated as a Subarea of the

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[*] On the Subsubareas of British India, illustrated by the detailed distribution of the Cyperaceæ in that Empire. *Journ. Linn. Soc. Bot.* xxxiv. 1.

Indo-Chinese Area,* the present paper attempts to divide into a convenient number (11) of Subsubareas for botanical reference." He has tabulated the Indian *Cyperaceæ* on this framework and says, "Only by a somewhat full trial can the convenience of a scheme of subsubareas be tested; moreover, it affords an opportunity for the suggestion of improvements in the scheme of subsubareas proposed." It is observed that the divisions are only tentative, as indeed they must be more or less, until tested by practical use. The employment of a definite group of plants (a Natural Order) to test the utility of the divisions, seems novel, and the precedent should be followed in New South Wales. The term "subsubarea" of Clarke appears to correspond to Flahault's "domaine" rather than to his "secteur," and affords another instance of the desirability of uniform nomenclature. Nevertheless, if botanists divide the different counties with which they are familiar into botanical areas as their local knowledge or predilection dictates, the mere fact of their working on definite lines, no matter how they differ in details, will result in the accumulation of valuable facts which will be capable of utilisation in the grand scheme of international classification of botanical areas which is foreshadowed in the early future.

"Could we but know the actual curving boundaries of a few hundreds of our best-defined species, what a wealth of new generalizations could be drawn from them, and how much new information they would yield concerning the factors which govern distribution in general!

"For, irregular as these lines would be, I can but think that they would in many cases stand in definite relation to lines of other kinds, to isothermals, to altitudinal contours, to degrees of humidity, to the boundaries of geological formations, the limits of glaciation, the ranges of animals, especially pollen-bearing insects, to the paths of bird-migration, and finally to the course of human traffic."†

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* *Phil. Trans.* Vol. 183. B (1892), p. 371.

† Dr. B. L. Robinson's Presidential Address to the Botanical Society of America. "*Science,*" Vol. xiv. No. 352 (1901).

Our results may, for many years, prevent us from affording satisfactory information in regard to a number of these points, but they are ideals, and should be striven after.

I show you to-night a "curving boundary" of one of our important species. This idea of graphic representation of range of species occurred to me many years ago, and I have had it in limited use for two or three years. It may proceed simultaneously with the main botanical map, and is, in fact, supplementary to it.

b. Topography (Plate xliii.).

EASTERN COUNTIES.

E1. Monaro County.

This consists of the well known tableland of the Monaro, and is bounded on the east by the Dividing Range, on the south by the Victorian Border, on the west by the Snowy Range (Mt. Kosciusko to Kiandra), and on the north by the Micelago Creek. It comprises the counties of Wallace, Wellesley, and Beresford.

E2. South Coast County.

While this district is commonly known as the "South Coast," the term "South Coast Range" should perhaps be added to it. It comprises the counties of Auckland, Dampier, St. Vincent, and Camden (exclusive of Illawarra and of that portion west and north-west of the railway line between Marulan and Mittagong).

E3. Illawarra County.

For botanical purposes I would define its boundaries as—east, the ocean; west, the Illawarra Range; north, the Cordeaux River; and south, the Coast Range.

As thus defined the Illawarra is a fairly definite botanical area. The South Coast and North Coast Counties include many portions of brush country very similar to that of the Illawarra. Different people, however, define the Illawarra differently.

McFarland in his "Illawarra and Monaro" (Sydney, 1872), defines the Illawarra as extending from Bulli to the Shoalhaven, and lying between the Pacific and the Coast Range; it is about

55 miles in length as the crow flies, and its width is from half a mile to ten miles. He has a footnote—"The lands that lie to the south of the Shoalhaven River are sometimes included under the term 'Illawarra'; but they are different in scenery, soil, and principal products from those on the north."

E4. Cumberland County.

This is the political county of the name, and includes the country in the neighbourhood of the capital (Sydney). It is practical and convenient to the majority of New South Wales botanists to retain this as a botanical division.

E5. Blue Mountains County.

This comprises the county of Cook, and is a well-defined area of sandstone mountains, including a few isolated volcanic mountain tops. The sandstone is chiefly Hawkesbury Sandstone.

E6. Hunter Valley County.

It comprises the counties of Northumberland, Durham, and Brisbane (east of Great Northern Railway).

It is largely sandstone, and of comparatively low altitude. The sandstone is chiefly Carboniferous, though that in the southern part is Permo-Carboniferous. To the north it is rather dry.

E7. North Coast County.

It comprises the counties of Gloucester, Macquarie, Dudley, Raleigh, Fitzroy, Clarence, Richmond, and Rous (between the Richmond River and the coast).

E8. Upper Richmond and Clarence County.

It consists mainly of elevated plains and slopes, and is grazing country for the most part. It is intermediate in character between New England and the coast. It comprises the counties of Gresham (eastern half), Drake, Buller, and Rous (West of Richmond River). This county is partly inclusive of the Upper Richmond River district as defined in W. S. Campbell's paper in *Agric. Gazette*, p. 416 (1899), with map.

E9. New England County.

This consists of the following counties:—Arrawatta (eastern half), Clive, Gough, Gresham (western half), Clarke, Hardinge, Sandon, Inglis (eastern half), Vernon, and Hawes.

Its boundaries are:—North, the Queensland border; east, the steep escarpment; south, the Liverpool Range; and west, the Liverpool Plains.

It has an average elevation of say 2,500 to 3,000 feet.

Different authorities vary in their definitions of New England. Mr. T. W. Connolly, the District Surveyor of Armidale, has kindly favoured me with the following note on the subject:—

"This district should be strictly regarded as being identical with the old pastoral district of that name, but the name has been adopted for a mining district which does not quite coincide with the pastoral district.

"Locally it has a more restricted meaning, and an attempt is made to apply it solely to the high lands. The escarpment on the east is not easily defined, as it follows gullies breaking into and forming precipitous falls so irregular that definition would be a laborious task."

E10. Liverpool Range County.

This connects the Hunter River county with the western country.

It comprises the counties of Bligh, Brisbane (eastern portion), Hunter and Phillip. It is one of the intermediate, or "stepping-stone" counties.

E11. Southern Tableland County.

Average elevation say 2,200 feet, and consequently somewhat lower than the northern tableland (New England). An indefinite or intermediate county shading on the west into the plains country, and on the east into the coast country. The Great Dividing Range runs through it in a south to north direction. Northern boundary, Cudgegong River; eastern, Blue Mountains and South Coast counties; south, Monaro; west, western boundary of Selwyn, thence northerly along the Central-Eastern Land to Yass, thence along the Boorowa River to Cowra and northerly to Orange, thence along the north-eastern boundary of Ashburnham, and thence along the Bell River to Wellington.

CENTRAL COUNTIES.

C1. Wagga-Forbes-Dubbo County.

This is another of the intermediate counties. It connects the tableland with the western plains.

Its boundaries are:—East, southern tableland and Liverpool Range county; north, Liverpool Plains; west, conventional lines joining Coonamble to Dubbo, Dubbo to Narrandera, and Narrandera to Corowa [a more correct boundary would be a somewhat sinuous line between Narrandera, Forbes and Dubbo]; south, Murray River.

C2. Liverpool Plains County.

I would define it as including the counties of Darling, Nandewar, Jamison (eastern half), Baradine (eastern half), White, Pottinger, Buckland, Parry, and the western half of Inglis. Bounded on the east by New England; on the west it tapers off into the sterile sandy country, and is bounded by a conventional line from Coonamble to Bogabilla; on the south by the Liverpool Range. Mean elevation say 900 feet.

C3. Macintyre-Gwydir County.

It includes the upper waters of the Macintyre and Gwydir.

It slopes from New England to the west, where it joins the sandy or sterile plains, being bounded by the conventional line from Coonamble to Bogabilla. It is a county corresponding in some respects (though drier) to the Upper Richmond-Clarence county on the east. The floras of C3 and E8 are somewhat different. C3 tones off into W4, while E8 tones off into E7.

WESTERN COUNTIES.

Western Plains.

The western plains comprise the greater portion of New South Wales, extending from north to south. There is considerable uniformity in the flora, but, chiefly because of its vast area, I have endeavoured to break it up, mainly on geological lines. The Murray-Murrumbidgee county is submitted as a fairly well defined botanical area, and the three other divisions are given with the view of ascertaining if they are a guide to the flora upon them. Certainly, as one crosses the Darling from the direction of Bourke, the vegetation is different, and we encounter sand-ridges and salt-lakes, but these are not confined to the Cretaceous, nor indeed to the trans-Darling country, as they are to be found east of the Darling in the Cainozoic country.

It seems desirable that such an unwieldy area should be broken down into convenient portions, if possible, and, if study of the areas I have suggested shows that they have no practical utility far botanical purposes, it may result in better divisions being indicated.

W1. Murray Redgum County.

This consists of the country enclosed between the rivers Murray and Murrumbidgee, and is bounded on the east by a conventional line joining Corowa and Narrandera. It includes the area liable to be flooded, comprising the valuable Murray Red Gum (*Euc. rostrata*) flats; much country similar in character occurs between the Murray and the Murrumbidgee. It has better soil than the other three western counties, and has much less mallee scrub.

W2. Cainozoic County.

So called because the area is mainly Cainozoic according to the geological map of the New South Wales Geological Survey.

The proposed boundaries are:—On the west, South Australia; north, 31st parallel to the Darling River at Myall in the east, thence south-easterly in a conventional line between the Myall and Condobolin, and intersecting the conventional line between Narrandera-Dubbo line referred to; south, the rivers Murrumbidgee and Murray.

In the "key" of the N.S.W. geological map, the Cainozoic area is defined as "Chiefly Pleistocene, with areas of red clay, rounded quartz pebble drift of probably Pliocene age, and deposits of black flood loam of recent origin."

W3. West Silurian County.

This consists of the Western Plains, in which Silurian rocks predominate. See the geological map already quoted.

Bounded by the Cretaceous and Cainozoic counties, and south-east by a conventional line that joins Narrandera and Dubbo.

W4. Cretaceous County.

It consists of Lower Cretaceous areas, with a few patches of Upper Cretaceous or Desert Sandstone. See the geological map already referred to.

The boundaries are Queensland on the north and South Australia on the west; and, on the south, parallel 31° and the Darling and Macquarie Rivers; on the east, a conventional line from Dubbo north to Coonamble and thence north-west to Boggabilla.

This subdivision, if tested, will at least prove if the Cretaceous has any special flora.

c.—BOTANICAL RECORDS ARRANGED TOPOGRAPHICALLY.

I submit a number of readily accessible papers arranged for the purposes of a botanical survey. I do not suggest that the list is exhaustive; one of our young members might readily make it so. Publications of this character might suitably be published in a separate series, after the fashion of the "Records of the Botanical Survey of India."

E1. Monaro County.

MAIDEN, J. H.—A List of Plants collected by Mr. Richard Helms in the Australian Alps. February, 1893. *Agric. Gazette, N.S.W.* v. 836.

——— —The Flora of Mt. Kosciusko. *Ib.* ix. 720.

——— —A Second Contribution towards a Flora of Mt. Kosciusko. *Ib.* x. 1001.

E2. South Coast County.

Maiden, J. H.—Notes on the Geographical Distribution of some New South Wales Plants. S. Coast. *These Proceedings* (2), iv. 107.

E4. Cumberland County.

Woolls, W.—Plants indigenous and naturalised in the neighbourhood of Sydney. Govt. Printer, Sydney. 1st Ed. 1880: 2nd Ed. 1891.

——— —Eucalypts of the County of Cumberland. *These Proceedings*, v. 288, 448, 463, 488, 503.

——— —Botany of the Parramatta District; Woods of the Parramatta District. *Contrib. to Flora of Australia* (1867), pp. 1, 89.

——— —List of Parramatta Ferns, etc. *Lectures on the Vegetable Kingdom*, 1879, p. 214.

E5. Blue Mountains County.

Cunningham, A.—On the Botany of the Blue Mountains. Barron Field's *Memoirs on N.S.W.* (1825), p. 323.

Woolls, W.—Kurrajong and Tomah. *Contrib. to Flora of Australia* (1867), p. 173.

Trebeck, P. N. Mt. Wilson and its Ferns. *These Proceedings* (2), i. 491.

Woolls, W. —A Glance at the Flora of Mt. Wilson. *These Proceedings* (2), ii. 6.

Hamilton, A. G.—On the Flora of Mt. Wilson. *These Proceedings*, xxv. 346.

E6. Hunter Valley County.

Woolls, W. Botany of Ash Island. *Contrib. to Flora of Australia* (1867), p. 184.

E7. North Coast County.

Rudder, A.—Forest Wealth of Gloucester. *Agric. Gazette N.S.W.* vi. 383.

MAIDEN, J. H.—Notes on a Trip to the North Central Coast Forests of New South Wales. *Agric. Gazette, N.S.W.* vi. 583.

——— —Mount Seaview and the Way thither. *Agric. Gazette N.S.W.* ix. 577.

——— —Notes on a Trip to Mount Seaview, Upper Hastings River. *These Proceedings,* xxiii. 20.

——— The Don Dorrigo Forest Reserve. *Agric. Gazette N.S.W.* 1894, pp. 218, 519.

E9. New England County.

CHRISTIE, W.—The Forest Vegetation of Central and Northern New England in connection with Geological Influences. *Journ. Roy. Soc. N.S.W.* xi. 21.

MAIDEN, J. H.—Notes on some Eucalypts of the New England Tableland. *Report A.A.A.S.* vii. (Sydney), 537.

TURNER, F.—The Flora of New England, N.S.W. (Abstract). *Report A.A.A.S.* viii. (Melb.), 275.

E10. Liverpool Range County.

BAKER, R. T.—Botany of Rylstone and the Goulburn River District. *These Proceedings,* 1896, 427.

HAMILTON, A. G.—A List of the Indigenous Plants of the Mudgee District. *These Proceedings* (2), ii. 259.

E11. Southern Tableland County.

WOOLLS, W.—Botany of Berrima and Mittagong. *Contrib. to Flora of Australia* (1867), p. 101.

MAIDEN, J. H.—Concerning Hill Top. *Agric. Gazette N.S.W.* vii. 263.

——— —A List of Plants collected in the Vicinity of the Jenolan Caves by W. F. Blakely and J. C. Wiburd. *Agric. Gazette N.S.W.,* xii. 1390.

ROSS, W. J. C.—Notes on the Flora of Bathurst and its Connection with the Geology of the District. *Report A.A.A.S.* vii. (Sydney), 467.

E11, E10, C2.

Cunningham, A.—Journal of a Route from Bathurst to Liverpool Plains. *Barron Field's Memoirs on N.S.W.* (1825), p. 131.

C1. Wagga-Forbes-Dubbo County.

Woolls, W.—The Botany of the Castlereagh District. *Lectures on Vegetable Kingdom* (1879), p. 61.

W2. Cainozoic County.

Woolls, W.—Plants of the Darling (Lower). *Contrib. to Flora of Australia* (1867), p. 192.

Deane, H.—List of Plants collected at Broken Hill and Tarrawingee, N.S.W. *These Proceedings* (2) viii. 329.

W3. West Silurian County.

Cambage, R. H.—Notes on the Botany of the Interior of New South Wales:—

1. From the Darling River at Bourke to Cobar. *These Proceedings*, xxv. 591.
2. From Cobar to the Bogan River above Nyngan. *Ib.* p. 708.
3. Mudall on the Bogan to Euabalong on the Lachlan. *Ib.* xxvi. 197.
4. Mt. Hope to Parkes. *Ib.* 317.

ii. SOME GEOLOGICAL CONSIDERATIONS.

a. ADAPTABILITY OF PLANTS TO CERTAIN GEOLOGICAL FORMATIONS.

The question of the connection between the botany and geology of a district is a fascinating one, but it must be confessed that we possess very few facts at present in regard to the extent that certain plants prefer, or are characteristic of, certain geological areas.

Mr. W. J. Clunies Ross, to whose paper[*] I have already referred, is carefully examining the flora of the geological formations of the Bathurst district, a line of research for which his geological and botanical knowledge specially fits him. I do not know of any other similar researches of recent date in this State. Mr. W. Christie's paper,[†] also quoted, may be usefully studied in this connection.

Howitt has a paper[‡] which deals with the distribution of Eucalypts on certain geological formations and soils in the masterly way that surprises no one who is acquainted with the depth of his knowledge of geology and botany. Although it applies to Gippsland, many of his observations are directly applicable to New South Wales.

Granite country does not appear to produce good timber in any part of Australia, while timber grown in swampy, low-lying ground is generally deficient in strength. These are generalisations that the ecologist will bear in mind.

Mr. Sydney B. J. Skertchly, Assistant Government Geologist, Queensland, in 1897 published a paper on the "Copper Plant" (*Polycarpœa spirostylis*, F.v.M.) to accompany his Report on the Mines of Watsonville, etc, in which he produced evidence that this plant frequently accompanies copper deposits in Queensland. He also gives a few instances which have come under his notice of the partiality of certain plants for certain geological areas, and also gives a few extra-Australian references. Still, we appear to have but few data on the subject. In Europe the subject has received attention since the time of Unger, and some general facts and observations bearing on the question will be found in Kerner and Oliver (ii. 495 *et seq.*).

In this connection I do not propose to touch upon the fossil flora of Australia and its interpretations; this has been considered by Unger in his "New Holland in Europe" (trans. in Seemann's *Journal of Botany*, Feb. 1865), by Ettingshausen and other eminent authorities, and the line of research is now being patiently investigated by one who possesses an intimate knowledge of our existent flora—my friend Mr. Henry Deane. We have an excellent geological map of New South Wales published by our Geological Survey, but a cursory examination of it shows that it can only be very partially used (in the present state of our knowledge at least) for the purposes of botanical record. This is, however, simply because the records of the geological survey of New South Wales are so much in advance of the botanical ones.

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[*] p. 771.

[†] p. 771.

[‡] *Trans. R. S. Vict.* 1890.

b. THE DISTRIBUTION OF PLANTS AFFECTED BY VOLCANIC OUTBURSTS.

In this matter of plant-distribution, when one contemplates apparent gaps in species between northern and southern localities, *e.g.*, when certain species common on the southern tableland give the Port Jackson district a wide berth and make their reappearance in, say, New England, one may ask, to what extent is the destruction of forests caused by volcanic outbursts responsible for the gaps in the sequence of forests in Australia? Mr. J. J. Fletcher has pointed out to me that Prof. R. Tate has discussed the matter* in connection with the paucity of land-mollusca in Victoria, but as regards the destruction (if such occurred) of the flora, I do not know whether geologists have published any evidence on the subject. It is only proper to reiterate that the records of a botanical survey are so very imperfect, that one must proceed very cautiously in stating that there are any gaps in the flora which may not be attributed to denudation of the soil and other causes, and where gaps appear it is because observation has not yet shown that there is an irregular line of continuity of occurrence† in any particular species. The student of ecology will very carefully endeavour to trace these lines of occurrence of particular (at all events of important) species, and I do not doubt that full data thus collected will prove of real value to the geologist in his task of mapping the rocks of the country. Perhaps the question of volcanic interference with our vegetation could better be studied in Victoria, where the outbursts are geologically more modern than in New South Wales.

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* Proc. R. S. S.A. iv. 73-4.

† Dr. B. L. Robinson's "Curving Boundary," *op. cit.*

c. THE DISTRIBUTION OF PLANTS AFFECTED BY ALLUVIAL DEPOSITS.

In dealing with the question of plant distribution, one enquires to what extent catastrophes by alluvial deposits have affected our flora.* I fancy that here again we have but little evidence. Where plant remains (of existent plants) are found they are generally logs of timber, woody fruits, resin and such like substances that are practically imperishable if entirely immersed in water, or freed from action of the air through sealing with silt-like deposits. As a very general rule the leaves and other soft portions of plants become, under such circumstances, disintegrated into a peaty mass or decay altogether. I give one of a number of recorded instances of submerged forests. A log, probably of a Eucalypt, was found in cutting a deep dyke. "The first three or four feet consisted of chocolate soil, which merged into a yellowish-clay loam, darkening again at the depth of about 10 feet into a peaty substance."† The deposit is further described.

I have recently‡ given instances of fossil or subfossil resins being found in Australia. They probably, in many cases, indicate submergence of forests by alluvial deposits, but of the magnitude of the destruction of the forests we know nothing.

Mr. E. F. Pittman, in a letter to me, says, "It is not an uncommon thing to get fossil resin (retinite), in connection with lignite, but I do not see how this bears on the question referred to. I may mention that rather extensive deposits of lignite occur in alluvial deep leads (in old river beds) at Kiandra, Forest Reefs, Molong, Gulgong, &c. I do not know whether you would consider this as evidence of extensive forest destruction, and the cause of these deposits, occurring as they do, in old *river beds*, is not quite clear to me."

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* Mr. E. F. Pittman, Government Geologist, kindly informs me that he knows of nothing like "extensive destruction of forests in this State by alluvial deposits. We get fossil trees in most of our deep (basalt-covered) leads, but nothing, so far as I know, in the way of extensive destruction."

† Col. W. V. Legge. "Note on timber found beneath alluvial drift at Swansea (Tasmania)." *Proc. R. S. of Tasm.* iv. 68.

‡ *Proc. R. S. N.S.W.* xxxv. 201, 202.

I am aware that changes in the distribution of our forests have probably more to do with climatic changes than volcanic or alluvial action (of the kind indicated). For example, we have evidence that at the close of Tertiary times there was a much greater rainfall than there is at the present time. The late Mr. C. S. Wilkinson, in his Presidential Address delivered before this Society in January, 1885, dealt ably with the subject, in regard to which there is already a copious bibliography, but at present I am alone concerned with the evidence, imperfect as it is, of the changes owing to the forms of geological action I have indicated.

iii. THE "PLAINS" OF THE DORRIGO; A PLEA FOR THE STUDY OF PHYSIOGRAPHIC ECOLOGY.

One phase of a botanical survey is the study of physiographic ecology. The aims and scope of this quite modern subdivision of botanical research are indicated, and a masterly summary of the ramifications of ecology generally given by H. C. Cowles.[*] Warming, in his classical work, divides what he terms "plant societies" into hydrophytes, mesophytes, and xerophytes, and ecologists have largely developed Warming's ideas with an extent of detail only possible because of the minuteness with which botanical surveys have proceeded in older countries, or at all events, because of the mass of data available.

A. N. Whitford has a valuable paper[†] supplementary to that of Cowles, whose pupil he is. He defines the factors to be taken into account in attempting to explain the relations that exist in different plant associations.

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[*] The Physiographic Ecology of Chicago and its vicinity; a Study of the Origin, Development and Classification of Plant Societies. *Botanical Gazette*, February, 1901, pp. 73 *et seq.*

[†] The Genetic Development of the Forests of Northern Michigan; a Study

A. Climatic factors.
  (*a*) Temperature.
  (*b*) Moisture.

B. Ecological factors.
  (*a*) Edaphic (the soil and its properties).
  (*b*) Atmospheric (heat, light, and influence of wind).
  (*c*) Hydrodynamic (action of tides and waves on strand vegetation).
  (*d*) Biotic factors (struggle for existence).

C. Historic factors. (Factors which involve the element of time, *e.g.*, certain geological and physiographic forces).

In tracing the genetic development of a forest, Whitford selected certain islands, etc., in the vicinity of Lakes Michigan and Superior, and examined four sets of physiographic formations :—

1. The Sand Societies.
2. The Clay Societies.
3. The Rock Societies.
4. The Swamp Societies.

Taking (1), he deals in succession with the "lower beach," "middle beach," "fossil beach," "heath," showing how a coniferous forest established itself in course of time on the heath, which is eventually succeeded, and even superseded, by the maple, beech and hemlock forest. The dune societies are incidentally touched upon.

(2) The Clay Societies are more difficult to trace than those found on the sand; but "in due time a maple-beech-hemlock condition is the result."

(3) The Rock Societies are traced, and in the locality selected it is shown that on the rocks (mostly granites and quartzites) the mesophytic forest (of maple, etc.) is not reached until first preceded by a coniferous forest.

(4) The zonal distribution of plants in swamps, as far as ce localities in the United States are concerned, is given, an general terms it is shown how the mesophytic (hemlock-m forest finally replaces the arbor-vitae or tamarack trees.

The paper finally deals with the effects brought abou human agency, the "clearing societies" brought into exist through the agency of man and domestic animals. As in United States, so in New South Wales, there are but few us records of plant-succession in clearings.

Little has been done in Australia in physiographical ecol I do not know that a systematic attempt has yet been mad classify "plant societies" in this continent. Following are s of them, but each group must be considered in regard to geolo and dynamical changes always in progress in any given ar No attempt is made to give a complete list; it is simply a sug tion.

Littoral Plants.
Coast Sand-dunes.
Western Sand-hills.
Brackish and Mangrove Swamps.
Brush Forests.
"Plains" (Dorrigo and others).

As an instance of the way in which the study of ecology be applied in a special case, let me bring under your no portions of the Northern Tableland, with especial reference to plains of the Dorrigo. I have briefly described these grass pl and the brush lands,† and my two papers (*loc. cit.*) on this a may be referred to. I feel that in the light of later experie I ought to undertake another visit to endeavour to solve s of the ecological problems I propose to bring under your not and which are of more than local interest, but I should be v glad if a young naturalist with fewer demands on his time t I have would carefully explore it.

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[*] See p. 784.

[†] Agric. Gazette N.S.W., x. 221.

The "plains" have much in common, I believe, with the "park lands" of Central Africa. Mr. J. E. S. Moore read a paper on the latter before the Linnean Society of London on 1st November, 1900. I have not seen the paper, but the following is an abstract:—

"These park lands in the Tanganyika have quite the appearance of having been formed by the hand of man, but are really natural growths, due to the fact that light surface soil has been laid down over what Mr. Moore takes to have been lake deposits. Any given line of country will show large plantations, with quite a home-like look, separated by grass lands; and, as Tanganyika is approached they dwindle in size till they consist of a few shrubs, overshadowed by giant Euphorbias, cactus-like in appearance. Then come stretches of grass, dotted with Euphorbias, and, last of all, the salt steppes by the Lake, which is now held to have had at one time an outlet to the sea. Mr. Moore's explanation is that, at first, only the Euphorbias would grow on the salt steppes; but as these sprang up they afforded a shade and shelter to self-sown shrubs, each of which, as it established a footing, contributed to the natural planting of the area by the distribution of its seeds, till this process reached its highest development in the large plantations where the shrubs overtopped the Euphorbias to which they owed their growth."

In passing reference to Central Africa country in comparison with our own, Sir Harry Johnston has a figure and description* of a "fine mountain which, like most Central African mountains, presents from below the appearance of a cake that has been cut and is crumbling." This mountain presents remarkable similarity to Mount Lindsay and other mountains in North-eastern New South Wales.

My personal acquaintance with the Ceylon patanas is of a very limited character, but I have long held the view that the plains of the Dorrigo present somewhat similar problems. Mr. H. H.

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* "British Central Africa," by Sir Harry H. Johnston (1897), p. 25.

W. Pearson has an important paper on "The Botany of Ceylon Patanas" (*Journ. Linn. Soc.* xxxiv. 300), and much of information contained in his paper (which includes an excel bibliography) will be found full of suggestion to us. Pata "are grassy slopes and plains of considerable extent occurrin all elevations above 2,000 ft." "Remarkable savannah- expanses in an otherwise forest-covered country" (pp. 300, 3 They correspond, in fact, to the plains of the Dorrigo and ot portions of the northern tableland.

Where the patanas come into contact with the western for the boundary lines* are remarkably sharp and abrupt, tho quite irregular and in no way related to any physical feature the land (p. 305). This also corresponds to the condition things in the New South Wales localities cited. "In the e the patanas pass gradually into an open park-like forest consist of low xerophytic trees and an undergrowth of grass" (p. 3 To what extent the Dorrigo plains differentiate into an o park-like forest is a matter for further enquiry, and care examination will show how much of the vegetation may be prope termed xerophytic. "The existence of extensive, comparati barren, patana-areas in the midst of the luxuriant sub-trop growth of the montane region, and, more particularly, the man in which they abut upon the boundary of the western fore have attracted the attention of many observers." To account the existence in such close proximity of two floras so wi different, three theories have been advanced (p. 307):—

i. Trimen's Theory.
ii. Abbay's Theory.
iii. Grass-fire Theory.

The line along which two plant societies meet has been called the ten line, whether between forest and heath or forest and prairie (plain, in Dorrigo sense). Here it is that the struggle is most pronounced. If other ecological factors remain constant, the tension line does not change, that case, for instance, the forest does not advance on the heath nor heath on the forest. But, as will be shown in the discussion of the histor factors, the conditions, as a rule, are changing constantly. Not only the struggle be between the forest on the one hand and some other typ plant society on the other, but it may be between different kinds of for (H. N. Whitford, *op. cit.* p. 293).

i. *Trimen's Theory.*

"Trimen gives his opinion respecting the maintenance of a definite line of separation between the western boundary of the patanas and the forest. He says that 'In the course of vast ages a perfect equilibrium between the two floras [*i.e.*, patana and forest] has been arrived at, so that now neither can encroach on the other: the patana plants are unable to exist in the dense shady forest, whilst the seeds of the forest-trees never get a chance even of germination in the closely occupied grass-land. So far as can be observed, this balance is now maintained without change.'" Pearson, however, shows that some change is taking place, though so gradually that it may be easily overlooked (p. 307).

ii. *Abbay's Theory*

(as regards one patch of the patana) is that the outcropping of "half-formed quartzite," which disentegrates into "little else than a quartz sand impregnated with iron, is entirely incapable of supporting the usual forest vegetation with which the district, except in this particular spot, abounds."

Pearson shows that this explanation can only be a partial one, and is dependent on geological data which are not forthcoming. The same remarks apply to the plains of the Dorrigo, no adequate geological data being at present available. The matter is of direct economic interest, inasmuch as settlers require information as to the soils. On the occasion of my trip, I made a carefully collected series of soils from both plains and forest, but unfortunately an accident happened to them while they were awaiting analysis. Careful analyses of the soils, selected, if possible, by a geologist, would, I doubt not, throw light upon the types of vegetation that are at present borne by the two kinds of land.

iii. *The Grass-fire Theory.*

The patana grasses are very coarse and wiry, and in their adult condition are unpalatable to cattle. The graziers' custom is to burn the grass annually to get a young growth of grass. "The country is temporarily reduced to a blackened waste which extends up to the very edge of the forest, where shrivelled leaves and charred trunks bear testimony against the maintenance of a permanent forest boundary. It is evident that the cumulative effect of such fires during a succession of years must be to materially extend the boundaries of the patanas at the expense of the forest. Experience shows that the constant occurrence of the patana fires is gradually extending the area of the patanas in a westerly direction into that previously covered by forest. With regard to the origin of the patanas as a whole, the cause is not so clear; there is a total absence of local tradition relating to a time when the main area of the Uva patanas was in any marked way different from what it is now."

"Above 4,500 ft.,* wide tongues of patana extend in a westerly direction up to, and in some cases over, the summit of the central ridge. There can be no doubt that these extensions are due to the encroachment of the Uva grass-fires into the montane wet-zone forest. Upon the cleared area a herbaceous vegetation has established itself, the remains of which form an accumulation of sour humus which is almost uniformly present on the surface above 4,500 ft. The properties of sour humus are such that forest-trees can with difficulty re-establish themselves upon it. It therefore follows that, apart from the effects of the present annual fires, the sharp boundary, once established by fire, would so gradually become irregular by the advance of forest-growth that only careful observations, extended over a long period, would be able to detect any change. Hence has arisen the idea that the present limit of the forest is a stationary one."

A careful survey of the Dorrigo plains, which is required in the interests of science, would show to what extent there is similar herbaceous vegetation between the plains and the forest. As regards the Dorrigo plains, the country as we know it is probably as it has been for many years; in bygone years doubtless the blacks fired the grass, and the white man has done the same by design or accident, but apparently not to any great extent

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* In the latitude of the Dorrigo this would approximately correspond to

In two papers,* Dr. Bessey maintains, from recent observations, that the greater portion of the State of Nebraska is capable of supporting a tree vegetation. He claims that the absence of trees is due to the prairie fires, and that now, wherever given a chance, the tree area of the State is spreading. In many places in our own State (including the Dorrigo) it is roundly stated that trees will not grow in certain localities, *e.g.*, grassy areas. If the statements were confined to "Trees have never grown on those areas since the country has been known to the white man," or "I do not think that trees will grow on these areas, but I have never tried the experiment," we should be on firmer ground. It has yet to be proved that these "plains" of the Dorrigo are incapable of supporting arboreal vegetation, though whether the planting would be undertaken on economic grounds is quite another question. The extent to which climate has been cause and effect in the matter is not known as regards the Dorrigo, in view of the short period that the country has been known to the white man, and the paucity of meteorological records.

Incidentally (p. 326) Mr. Pearson discusses the matter of ethereal oils in the *Labiatæ* and grasses of the patanas. I am sorry I made no observations of this character in regard to the Dorrigo plains. He reviews the interpretations of Tyndall's observations in regard to the arrest of radiant heat through the diffusion of minute quantities of essential oil in the atmosphere, also Dixon's later researches, all of which is important in view of the desirability of a clearer understanding of the effects on climate and vegetation in Australia of the exhalation of natural Eucalyptus oil.

Much of the collecting in New South Wales is of a spasmodic character; as far as I know, the term "advanced collector" is only applied to the votaries of the postage-stamp cult; I would apply the term, if it be necessary to coin one, to the collector who collects with a definite object other than that of systematic botany, say, that of solving problems of ecology. The field of physiographic ecological study is vast, and it will be found most fascinating. It has not been taken up until late years because, in many cases, the necessary geological and botanical foundational data were not available. It is obvious that every district requires its own special treatment. Following is a brief statement of the method of classification adopted by Cowles* in dealing with the Chicago area, and it may be observed that he is the first botanist to clearly bring out the dynamic conditions due to physiographic changes.

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* "The Forest and Forest Trees of Nebraska." *Rep. Nebraska Board of Agriculture*, pp. 79-102, 1899.

"Two general groups are made, the inland and the coastal. The inland group is subdivided into three series, river, swamp, and upland. The coastal group is subdivided into two series, lake bluff and dune. The river series is remarkably tortuous, involving constructive and destructive, progressive and retrogressive phases. The treatment begins with an erosion gully; then there follow in order the ravine, both in clay and in rock, the xerophytic bluff, and the mesophytic forest. The depositional phases of the river begin with the appearance of a permanent stream; then follow the various stages of the flood-plain, culminating in the mesophytic forest. The swamp series begins with the pond, treats next the various types of swamps, and ends with a brief discussion of the prairie. In the upland series the various stages of the rock hills and then of the clay hills are taken up in turn, culminating in the mesophytic forest. The coastal group is next discussed, beginning with the lake bluff. Finally, there is a brief treatment of the dune series from the beach on through the embryonic and active dune to the established dune on which there finally appears the mesophytic forest."

The special ecological classification adopted by Thomas H. Kearney† for the vegetation of Ocracoke Island is worthy of note, and the paper itself contains many valuable suggestions.

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* *Op. cit.* p. 85.

† The plant-covering of Ocracoke Island; a study on the Ecology of the North Carolina strand vegetation, by Thomas H. Kearney, Junr., *Contrib. from U.S. Nat. Herb.*, Vol. v., No. 5 (1900).

iv. THE SO-CALLED "SPONTANEOUS" GROWTH OF TREES.

Allied to this "Patana" question is that of the so-called "spontaneous" growth of trees.

"I was informed* here (Failford) and also on the A. A. Company's Estate (Gloucester) that formerly the hills were often destitute of timber where now there is dense forest. The reason of this change is attributed to the overstocking of the country, the stock eating down the grass, so that bush fires (which formerly consumed the seedlings of forest trees) are now less frequent, and devastate smaller areas of country than they used to do. . . . Mr. Forester Rudder expresses the opinion that cattle directly aid the propagation of trees by trampling the seeds into the ground."

In Tasmania (perhaps in Australia) the following experience is not uncommon. Where sheep are folded the manure becomes quite thick. In a few years, if the sheep be removed, Eucalypts come up freely. This occurs in places in which they were not previously found. It seems to me that this points to the sheep licking up the seed with their feed and redepositing it in manure. Vigorous growth would take place in fertilized soil. Perhaps this matter of natural afforestation (not re-afforestation, as it takes place in areas not previously known to carry trees), may be entirely explained by herbivora grazing in forest land and depositing their dung on non-forest land. The obvious reason why this afforestation does not take place more abundantly is because sheep and cattle readily eat down young seedlings, which must therefore be protected accidentally or otherwise in order that they may reach maturity.

Howitt deals with the "Influence of Settlement on the Eucalyptus Forests" in his paper on the Eucalypts of Gippsland (*op. cit.*). He speaks of the annual bush fires of the aborigines which tend to keep the forests open; consuming much of the standing or fallen timber and largely destroying the seedlings. At the same time these burnings off destroy many of the insects that prey on Eucalypts. When the white man came he discouraged bush fires, and the young seedlings had now a chance of life. He gives specific instances of whole tracts of country being covered with forests of young saplings since the advent of the white man. No one has a more intimate knowledge of Gippsland than Mr. Howitt, who says, "in spite of the clearings which have been made by selectors and others and in spite of the destruction of Eucalypts by other means (plagues of leaf eating insects) the forests are more widely extended and more dense than they were when Gippsland was discovered by the white man."

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* Maiden in *Agric. Gazette N.S.W.* vi. 593 (1895).

This natural spread of forests should be a comfort to those who are apt only to consider the destructive action of the timber getter, and to lose sight of the compensating influences that are at work.

The springing up of young forest growths where there was formerly forest is, of course, common enough. We do not know how long many seeds will remain dormant in or on the ground after the old growth has been removed. It is not an uncommon thing to see a straight avenue of trees not artificially planted. One fine avenue known to me is along the line of an old chock and log fence, and consists of She Oaks (*Casuarina*).* Oak saplings were used as top-rail for this fence, and the seed from the saplings germinated and the young growth was protected from stock by the fence. The seedlings grew into fine trees, and finally the old fence was removed, leaving only the line of trees which followed the direction of the fence.

6. AUSTRALIA'S DUTY IN REGARD TO BOTANICAL INVESTIGATION IN AUSTRALIA AND POLYNESIA.

The South Sea Islands are of special interest to us in New South Wales, Sydney having more intercourse with them than any other Australian port. They are mainly under the political control of Great Britain, France, and Germany, and all three nations have most honorable records in regard to the advancement of botanical science in those regions. At the present time most of the botanical work in the Islands is being done by Great Britain and Germany. The former is carrying on the work, speaking generally, in an intermittent way, organised expeditions for collecting purposes and investigation being infrequent. She has enormous numbers of types, and largely relies on the free-will contributions of travellers and others. Germany, on the other hand, is systematically working up the floras of her dependencies, and the efforts of the Royal Botanical Museum at Berlin in this direction are continuous and indefatigable. A number of publications, some of them of considerable proportions, have already been issued, and every year adds to the volume and value of them. Our German friends attain these results in a variety of ways. Their governing officials in the islands often include scientific men, some of them botanists, or at all events botanical collectors. The Imperial Government, through the Royal Gardens at Berlin, or through other botanical establishments, wholly or partially defrays the expenses of young botanists engaged in definite lines of botanical research. The medical officers of her steamships and war-vessels are often men with more or less botanical training, and, I am given to understand, receive greater encouragement to solve botanical problems or to make botanical collections than do British officers in similar situations. The acquisition of botanical collections is, in a measure, incompatible with that preservation of faultless tidiness of decks and other parts of the ship which are the traditional pride of a commander of a British man-of-war, while the accommodation available to officers for the storage of collections, books, &c., is so limited as, in many cases, to preclude a man from preserving any specimens to illustrate the observations recorded in his note-book. This is the more to be regretted, as warships, during police or surveying duty, often touch at places which are rarely, if ever, visited by trading vessels. Has not the time arrived when Australia should systematically undertake a share of this botanical work in the South Seas? Are we to sit down and let British, French, and

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* *E.g.*, *Agric. Gazette*, vii. 514.

German botanists do all the work and permit the world to assume that Australia is unwilling or incompetent to help to reap the harvest? Cannot the Federal Government, or individual State Governments, or our Universities, despatch young University graduates with missions to these islands, or even pay the expenses of trained collectors to systematically acquire material for the botanical establishments of the mainland? I am not suggesting any impossible idea, nothing costly or beyond our resources in any way. Australia is waking up to her responsibilities and destiny in various ways. Her States have federated. Her troops have fought shoulder to shoulder with those of other parts of the Empire. She has sent forth commercial ambassadors to London, to South Africa, and to the East to make her name and her products better known. The carrying out of my suggestion to maintain, say, two young botanists and one collector in the Islands, would involve an aggregate cost scarcely greater than £1000 per annum for salaries, travelling and incidental expenses. I would give a young botanist a commission for say two years, and if he were doing good work and desired a further term, an extension could be arranged. It will be seen that I have allowed for small salaries: nevertheless I believe that suitable volunteers, anxious to win their scientific spurs, would always be forthcoming.

But let us come a little nearer home. When I was in Berlin in 1900, I was informed that the Royal Botanical Garden there was on the point of despatching two young botanists to investigate the flora of Western Australia. They have remained in that State fourteen months, and, I believe, have done magnificent work. They are now engaged in visiting all the other States, and I do not doubt that an account of their researches will prove very valuable to us. But might not Australian botanists be excused if they were to be a little envious of the great good fortune of their German brethren? Many of our botanists would dance with joy if they could be detached for botanical investigation for fourteen months, or even for half that period, in many localities that would be promptly indicated. Our own Government, which maintains two botanical collectors (attached to different institutions), whose sole duty it is to investigate the botany of New South Wales, is largely seized with its duty in the matter of botanical work, but I hope the time is not far distant when our well-to-do citizens will feel moved to devote a portion of their wealth to the advancement of botanical work irrespective of the political borders of the Australian States. It is, in fact, impossible to investigate the botany of any one State without overstepping the territory of others, but there is much virgin country yet within New South Wales, and I trust the plea I have advanced will not be in vain.

7. Hybridisation Work in New South Wales.

During the past year an interesting Orchid hybrid raised by one of our Members (Mr. F. Godwin, gardener to Dr. John Hay) was exhibited before this Society. It is *Cymbidium Lowianum* × *C. eburneum*, and it is figured and commented upon in the *Gardeners' Chronicle*, 13th July, 1901, p. 25. The statements are made, "This is the first, so far as our knowledge goes, cross-raised and flowered in Australia. . . . The flowers measured 5½ inches across, which is quite equal to the standard in point of size."

For an account of the extensive and successful work that has been carried out in Europe and America in regard to the cross-fertilization of plants, one need not go further than the records of the Hybridisation Conference held in London in 1899, which was fully reported in gardening and botanical journals, and in the Journal of the Royal Horticultural Society. Mr. Peter Barr's address on Hybridisation before the Royal Horticultural Society of Victoria in August, 1900, on cross-fertilising daffodils is valuable, and so also are the papers on the same subject by Mr. H. H. B. Bradley, of Sydney, in the "Australian Agriculturist" for October and November, 1900.

Mr. Julius H. Camfield, a Member of this Society, contributed a useful little paper to the same Journal in its issue of November, 1901, in which he makes suggestions for experiments with certain native plants.

Many successful variations are not the results of experiment, but of accident. An observant man making his rounds through his garden has acquired fame, and sometimes fortune, by observing peculiarities in the growth of self-sown seedlings, fertilized without human aid.

Progress with hybridisation and selection work in Australia is slow, as we have not at present a number of well-to-do amateurs possessing the necessary knowledge and enthusiasm, as in older countries. Many experiments in hybridisation (and not a few with varieties) have been carried on at the Sydney Botanic Gardens, chiefly by Mr. George Harwood, a veteran in experimental work. In fact I doubt whether any man has done more in this direction in New South Wales than my colleague. I am happy to say that some experiments are still proceeding at this establishment in regard to which I hope to be able to announce successful results later on. In a recent Annual Report of the Gardens I expressed the hope that we may have a small physiological laboratory to serve for the headquarters of experiments in hybridisation and for cognate work with our delightful wealth of material. When public opinion is sufficiently educated in this matter, I do not doubt that Parliament will readily place the necessary funds at my disposal for the employment of one officer whose exclusive duty it will be to carry out experiments of the kind, and for means (necessary in a public garden) of protecting our experiments from the depredations which have discouraged us so much in the past.

Many crosses, *e.g.*, of Verbenas are the result of accident. The difficulty of raising plants begins when one gets so far as making a cross. If any accidents happen to these seedling plants one, of course, has to work *de novo*. We have to select parents, to wait until the seed has set, then to wait until the plants can be raised, and further wait until flowers are obtained. These results often take several years to obtain, and may in the end have little or no horticultural value. Many of our experimenters have had disappointments, but I am sorry they have not kept a careful record of their results. If the experiments are worth making at all, they are worth recording, and even negative horticultural results have scientific value.

Returning to Mr. Godwin's work, I am glad to hear that he is working at *Cattleya* and *Laelia* hybrids, also at *Cypripedium, Zygopetalum, Lycaste, Dendrobium* and *Phaius.*

Mr. Hugh Dixson, also one of our Members, has obtained good results with *Dendrobium bigibbum* (an Australian species), *Phaius* and *Spathoglottis;* while Mr. Williams, gardener to Mr. Onslow, of Camden Park, has done good work with *Vanda teres* and several *Cypripediums.* Mr. D'Arcey, Orchid-grower at the Botanic Gardens, has experimented with *Cattleya, Laelia* and *Cypripedium;* while Mr. Hazlewood, of Botany, is another experimenter with Orchids.

Most of us admired the beautiful *Hippeastrums* raised by the late Mr. Burton Bradley. His son, Mr. H. H. B. Bradley, has obtained a solid reputation with *Narcissus,* and for some account of his work my readers may refer to his paper already quoted. He tells me that his father left no record of what he did with *Hippeastrum,* and with regard to present work, he writes, "What I have done with other flowers is immature; perhaps if I live another twenty years I may have something to say about it."

Of other bulbous plants I have little to say. The late Sir William Macarthur did good work with *Gladiolus* and *Crinum.* Mr. Baptist had many successes with *Hippeastrum,* but like Mr. Burton Bradley, made no records. Mr. H. Selkirk, of Sydney, is at work cross-fertilising bulbs, and we may expect results from this conscientious worker in due course. The late Mr. T. S. Mort obtained excellent results with *Phyllocactus.* Although the employer of gardeners, he himself undertook the work of polliniating as a recreation from his many absorbing public pursuits. Mr. W. H. Catlett, later on, did good work with the same group of plants.

With *Anthurium Scherzianum* the same cross has given Mr. Godwin rose-pink, geranium-lake, and a good white variety. Mr. G. H. Kerslake, of Rookwood, has done a good deal in cross-fertilising Chrysanthemums and Bouvardias, and has attained some fine results. Both he and Mr. J. H. Horton have rai good Chrysanthemums which have been approved in Engla Mr. Kerslake and Mr. W. M. Butterworth have both raised so fine Dahlias, and Mr. H. J. Carter has raised some very g Carnations.

A considerable number of florists' flowers, such as Ro Dahlias, Carnations, Pansies, Gladioli, Hippeastrums, &c., h been raised by various horticulturists of this State, but I h no details of their work, nor do I even know, in most ca whether they were crosses or varieties.

Let me invite your attention to the beautiful water-col drawings of a fine series of *Hibiscus* raised at the Sydney Bota Gardens by Mr. George Harwood. They are true hybrids, my opinion, although there is some doubt at present as to whet the parents are distinct species or only extreme forms of variable *H. rosa-sinensis.*

The drawings show five seedlings, the parents being *H. ro sinensis*, var. *General Courtegis* (pollen-bearer), and *H.* sp. (p haps a form of *H. rosa-sinensis*) from the South Sea Islan (seed-bearer). Only one fruit has been produced from the see bearing plant during the fifteen years it has been under cultiv tion in this State.

The flesh-pink flower has been deservedly admired, both for t delicate colour of its petals and for the size of its flowers. flowers freely in the Sydney Botanic Gardens, is well worthy a name, and I have much pleasure in calling it "George Harwoo after its raiser.

I understand that the late Mr. R. D. Fitzgerald did some wo with the cross-fertilization of *Hibiscus*, *Abutilon*, &c., but I ha not been able to learn any particulars of his results.

Such is a cursory account of what has been done in hybri sation or cross-fertilisation by workers in this State, often und great disadvantages, and I hope that a mere recapitulation of will incite others to further enterprise.

8.—COMPARATIVE STUDY OF SEEDLINGS AND SUCKERS (A PHASE OF ONTOGENY).

"I would call attention to recent researches in plant ontogeny; the investigation of embryonic development, the comparative study of seedlings, and such observations as have been recently made by Prof. R. T. Jackson upon the reappearance of juvenile and ancestral traits in offsets and runners."*

Dr. Robinson then points out that while systematic zoologists have long made use of ontogeny in determining group affinities, botanical taxonomists have been much less successful in drawing from the early stages of plants like inferences. "Ontogeny has for the plant-taxonomist a wealth of information as yet unrevealed regarding the affinities of genera within the family, and species within the genus. . . . The form, position, and venation of leaves, the nature of the petioles, stipules, pubescence, and glandularity, all shown in the seedling, are significant." Let me draw attention to this fascinating field of enquiry in Australia. The only genus, as far as I am aware, in which observations have been systematically made in this direction is *Eucalyptus*. Mueller drew attention to the value of seedlings and suckers for diagnostic purposes, and Mr. Deane and I may fairly lay claim to have insisted on their great importance in taxonomic work. Lubbock's work on seedlings will at once occur to one in this connection. Mr. L. Cockayne† has recently published some valuable observations on seedlings in continuation of his former researches, while at the Sydney Botanic Gardens I have inaugurated a systematic examination of seedlings. The study of suckers and seedlings places a powerful weapon in the hands of systematists in the classification of plants. It is obvious, of course, that the experimenter who undertakes this line of research should either be a good systematist himself, or should co-operate with one. I have thus cursorily alluded to a subject which is so important ar full of general interest that it deserves much ampler treatm

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* Prof. B. L. Robinson, *op. cit.*

† An Inquiry into the Seedling Forms of New Zealand Phanerogams and their Development. *Trans. N.Z. Instit.* xxxiii. 265.

9.—EUCALYPTUS.

(a) *A critical revision of the genus.*

Many years of travel in our forests, and critical examina of botanical material, brought the fact home to me very cle that in many cases it was necessary to obtain access to ty Many species of our national genus *Eucalyptus* were describe a period when botanical descriptions were frequently inadequ furthermore, recent monographers had not access to certain t at all. I arrived at the conclusion that the only satisfactory of dealing with the genus was to obtain the original descrip in every instance and, if possible, the loan of the type, a gift co-type or a fragment of the type or, in the case of uniqu drawing made by a botanical artist. The principal object of visit to Europe in 1900 was to ascertain where the types w and to inspect as many as possible. I made copious n in various British and foreign herbaria, made arrangem for copies of descriptions from works not in any Austra library, and for faithful drawings of uniques. For these I chiefly indebted to the kindness of Kew. Since my return I h been entrusted with the loan of a number of important collecti of specimens of the genus numbering from about forty to ne a thousand. It is a mark of confidence in ocean steamships, in me personally that I much appreciate, that directors controll irreplaceable national collections should permit their treasure be sent to the Antipodes and back. Many of the specimens of the greatest interest and a number, I find, were not s either by Bentham or Mueller. Where duplicates of r specimens were available, they have been willingly presented the National Herbarium at the Botanic Gardens, and it is advantage to science that I have figured uniques, for one shudd at the sight of a priceless, unfigured specimen, that might read be damaged or entirely lost. I am going to the bed-rock, so speak, with every species, and have already made a large num of interesting observations. A number of discoveries of more or less importance are only awaiting time and opportunity for publication; in other cases interesting lines of enquiry have been suggested which, it is hoped, may, in some instances, lead to a better knowledge of the genus. The research has developed into one of far greater magnitude than I anticipated when I left for Europe, but I have put my hand to the plough and will not turn back.

b. Variation in Eucalyptus under cultivation.

The variation of Eucalypts under cultivation is remarkable, and study of it promises some valuable results. So much, indeed, do these plants depart from the types that Naudin, Trabut and Kinney have between them described a large number of new species from cultivated plants in the south of France, in Algeria and in California respectively. Mueller always maintained (1) that it was in the highest degree improbable that species unknown in Australia should have persistently escaped the notice of collectors other than seed-collectors; and (2) that the cultivated species were really varieties of spontaneous species. I have seen additional cultivated "species" which have been published since Mueller's death and others which he never saw, and I also agree that those I have seen so far are but cultivated varieties of our species. However, in order to make observations really valuable, collections of cultivated Eucalypts should be made in as many parts of the world as possible. I have already accumulated a large series, and it is my intention to depict variations from the type, this being a research in which profuse pictorial illustration is absolutely necessary. So far as I have gone, I can say that Eucalyptus under cultivation exhibits variations which throw valuable light on the affinities of the spontaneous varieties to the types, and also indicate affinities (perhaps in some cases unsuspected) between species. When our facts are properly classified, I do not doubt that the study of cultivated forms will be a most powerful adjunct to a study of the spontaneous ones, enabling us to better assess the relative value of species, and to group the members of this protean genus, with respect to their true affinities, better than is possible in the present state of our knowledge. In connection with this work I have, as hinted already, been for some time collecting seedlings of various Eucalypts, in regard to which I possess, otherwise, full botanical material.

The genus *Eucalyptus* is given prominence to for obvious reasons, but the amount of variation in other genera may be as great. Where Australian Acacias have been grown for long periods, *e.g.*, in the Riviera and California, variation has (in some groups) proceeded to such an extent that it is often impossible in the present state of our knowledge to indicate the species from which they have sprung. Variation is not confined to the phyllodes, but extends to the minute floral organs.

10. WHAT IS A SPECIES?

A species is the embodiment of a theory—a working hypothesis. It is a standard or rallying point, around which we range the vegetable units. No species can be absolutely definite, except as regards the type itself, although in the present state of our knowledge the contrary may appear to hold good in some cases. We strive after a wrong ideal by making the boundaries of a species too rigid; species-names are a convenience of classification, and the process of variation, the natural manufacture of species, is going on everywhere around us.

Inasmuch as a species is an hypothesis, there will be varying opinions as to the value of any one in particular. A man may be an extremist in two ways: he may be a consolidator or "lumper" of species; this fault of extremism is comparatively rare. Fortunately in the other direction we have few extremists of the type of Swainson,* who must have spent much of his time with his Latin dictionary hunting out adjectives, and finally "exhausted" the supply.

Swainson's Report is one worthy of more than passing notice. He was an F.R.S. and a respected scientific man (a zoologist), and yet he had the temerity to give an exhibition of reckless species-making that, as far as I know, stands unparalleled in the annals of botanical literature. As a "shocking example" of what lengths an unbridled systematist may go to, it certainly should not be buried in the pages of a geological Blue-book.

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* "Further Papers relative to the Discovery of Gold in Australia." Presented to (Home) Parliament, December, 1854. Victoria, 24 Nov., 1853

EUCALYPTIDÆ.

I. Dried specimens of the sprigs in separate papers, the different genera (all new), or the principal divisions of the family, marked on each :—

1st Series	68
2nd Series	297
3rd Series	160
4th Series (species growing on the Government Domain, Melbourne)	39
	564

II. Species and varieties contained in small paper bags, labelled as above, each containing capsules, leaves, and (where procurable) seeds and buds :—

1st Series	33
2nd Series	167
3rd Series	691
4th Series. From the Government Domain	39
	930

III. Papers of sprigs of the capsules, etc., collected on the Blue Mountains, New South Wales	26
Total of species and varieties	1520

Pines.

A series of large bags and tin cases, numbered and named, of all the species of *Casuarineæ* examined and determined from 26th July to 29th September (a few separate packets of "unexamined species")	201
A series of large bags and tin cases of my new genus *Echinocarpus* or Grass Pines, numbered and named	21
	222

"List of species of Casuarineæ or Australian Pines, discovered, named and described by Mr. Swainson, and of which seeds and cones (mostly in abundance) have been collected for the Victorian Government."

Then follows a list of 213 species of Casuarineæ, with botan names and English equivalents. Mr. Swainson has a note :—

"In several instances different species and numbers appear under the s specific name. All these must therefore be considered provisionary, arose from not keeping a memorandum of the names I had already u Without a single book to refer to, I have been obliged to leave several of latter species unnamed (although described) rom having exhausted all specific names I can think of that were at all applicable to the species."

There were two portfolios "with drawings and dissectio natural size and magnified, of different species and genera* *Eucalyptideæ*." . . . "These drawings will be person delivered to the Curator before I leave Melbourne."

I have not been able to trace what became of the drawin descriptions (of *Eucalyptideæ* and *Casuarineæ*) and of the sp mens. Mueller probably allowed them to find their way to rubbish heap.

Hooker's *Journal of Botany*, vi. 186 (1854), has some furt information in regard to Swainson's Botanical Report. Lie Governor Latrobe appointed Mr. Swainson "to study and rep on the timber of the colony (Victoria), chiefly *Eucalypti* *Casuarineæ*." The Journal contains a letter, dated 2nd Octo 1853, from Swainson to Latrobe, which is not contained in official document I have already quoted.

In connection with the question of variation and limits species, I would invite attention to Darwin's "Origin of Specie I have used the sixth edition, and chapter ii., "Variation un Nature," deserves to be carefully studied. The extracts I g have been taken from that chapter. "The general tendency the young† naturalist will be to make many species, for he w become impressed, just like the pigeon or poultry-fancier bef alluded to, with the amount of difference in the forms which he is continually studying."

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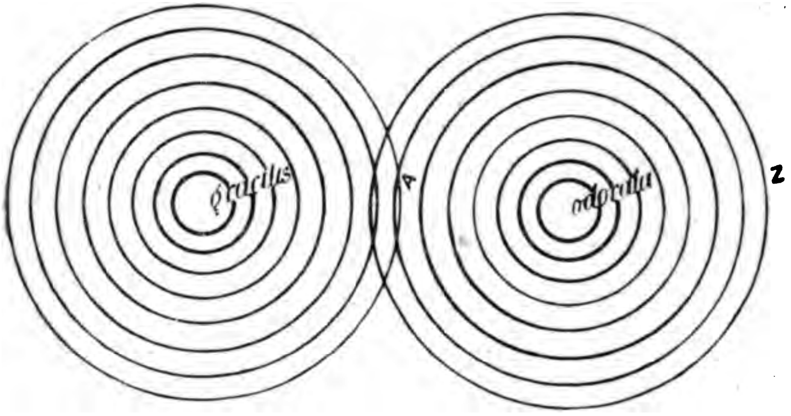
* What these genera are I do not know. Swainson refers to *Canthocar* (Red Gum); *Tricanthus* (the "Straight Stringybark"), of which "there numberless species;" *Microcarpos* (Native Box), of which he collected few species."

† If Darwin had known of Swainson's exploit he would have seen that t tendency is not confined to youth.

Then again he states :—

"Practically when a naturalist can unite by means of intermediate links any two forms, he treats the one as a variety of the other; ranking the most common, but sometimes the one first described, as the species, and the other as the variety. But cases of great difficulty sometimes arise in deciding whether or not to rank one form as a variety of another, even when they are closely connected by intermediate links; nor will the commonly-assumed hybrid nature of the intermediate forms always remove the difficulty."

An extensive acquaintance with the genus *Eucalyptus* shows me that the more one proceeds with a study of it, the more we find barriers break down, variations presenting themselves in the most unexpected ways. Let me illustrate my point by a homely diagram. The centres of the circles are species, we will say *Eucalyptus gracilis* and *E. odorata*, for the sake of argument.



Around the centre of each, forms accumulate which more and more diverge from the types, as shown by the spreading circles. The plant represented by the circle at Z still belongs to *odorata*, but it is a good deal removed from the type. As these circles diverge, they intersect the circles belonging to other species, say at A for example. In other words, a plant at A partakes of certain characters both of *gracilis* and *odorata*. A systematist may think it his duty to interpose a species at A, as he is unable to recognise it as a form of *gracilis* more than *odorata*. This does but alter the position of the difficulty, as further discoveries bring to light fresh circles which invade other spheres of influence.[*] To put the matter in another way,—where it is found that two species have affinities, a man may, by unduly concentrating his attention on one, imagine that the forms of both may be looked upon as forms of one. For example, it is quite easy, by a kind of induction, to make all specimens of *odorata* and *gracilis* forms of one or other species only. This is where the personal equation comes in, and to quote Darwin, "the opinion of naturalists having sound judgment and wide experience seems the only guide to follow."

A further remark of Darwin's is much to the point:—

"Hence it is the most flourishing, or, as they may be called, the dominant species—those which range widely, are the most diffused in their own country, and are the most numerous in individuals—which most often produce well-marked varieties, or, as I shall consider them, incipient species." Such species as *Eucalyptus Gunnii*, *viminalis*, *tereticornis*, and *amygdalina* present many confirmatory illustrations of the truth of Darwin's remarks. In this connection I would invite attention to Darwin's dictum:—

"Species of the larger genera in each country vary more frequently than the species of the smaller genera."

The perplexing results of attaching names to too many forms of Eucalyptus has been prominently before Mr. A. W. Howitt, with whom I have often discussed the question. He is of opinion that names should only be conferred on "groups," which is an ideal not attainable in practice, since the difficulty of defining a species is only transferred to the "group."

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[*] This expression is a convenient one, though of course, strictly speaking, there is no "influence" at all.

Our zoological friends sometimes experience a similar difficulty, a discussion having recently taken place at the Linnean Society of London* in regard to the difficulties that present themselves in defining and naming corals.

In the matter of dealing with individual differences of forms, Darwin may again be quoted :—

"It should be remembered that systematists are far from being pleased at finding variability in important characters. . . . Authors sometimes argue in a circle when they state important organs never vary; for these same authors practically rank those parts as important (as some few naturalists have honestly confessed) which do not vary."

Dr. Robinson† expresses a similar view in different language :—"It is easy to see that species as now recorded in literature are by no means alike, and that they cannot be regarded as equivalents in any complete or logical system of classification. Curiously enough the term "species" seems to be growing more and more popular, as it means less and less.‡ Often and on all sides we hear lengthy arguments and emphatic asseverations to the effect that this or that plant is a 'perfectly good species,' and if in the course of monographic work a so-called species is let down to varietal rank, it rarely fails to find somewhere its ardent defenders, who appear to hold the curious view that the monographer has not merely expressed a scientific opinion, but has somehow perpetrated an injustice upon the plant or its describer."

It will soon be accepted as indisputable that "species must be subjected to a gradual reclassification along more definite lines. . . Each species must be examined in the light of vastly more copious material than at present exists even in our largest herbaria. . . . Let us, then, proceed with the accumulation of material, with the collection of specimens that may illustrate each species at every stage of development, in every part of its range, in every environment in which it occurs. In this matter we are much behind zoologists; they often work with hundreds, or even thousands of specimens, while we try to draw like inferences from dozens."

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* "On the necessity for a provisional nomenclature for those forms of life which cannot be at once arranged in a natural system." By H. M. Bernard. Abstract in *Proceedings*, Nov., 1900-June, 1901, p. 10.

† *Op. cit.*

‡ It will be observed for instance, in passing, that Mr. F. M. Bailey is very sparing in the use of varieties, making his named forms species instead.

11. The Duty of Clearly Indicating Species.

Mr. J. J. Fletcher has shown* what sad confusion and waste of energy have arisen through failure on the part of the early zoologists to preserve records of their Australian types, and although Australian botanists are in a far better situation than their zoological confrères, there are many instances in which energy has been wasted in fruitless speculations in regard to types, which are of course the foundations on which systematic botany rests. Just as a building may come crashing down through a defect in its foundations, so may a large superstructure of observations be rendered useless and perhaps even mischievous because built upon a mistaken type. Further, everyone who describes a plant takes upon himself a responsibility to see that present and future generations may precisely understand the plant described. I refer to this important matter before this Society with the greater emphasis because I assert that the botanists who have contributed to our Journal during the last few years have kept this duty very clearly in mind. Dr. Robinson lays great stress on publishing the exsiccati-number of types. But in Australian herbaria the practice of cataloguing their contents is in its infancy. Herbaria in this continent only date from the time of Mueller, Australia being looked upon merely as a collecting ground for other (chiefly European) nations, and the idea of forming a herbarium in Australia never seemed to have been thought of until the expiry of the first half of the nineteenth century. But the method of indicating a type is perhaps a detail; all that we should insist upon is that the author shall unmistakably indicate on his label his type, and, if necessary, afford access to it. He will save trouble in the latter respect by distributing specimens to some of the leading herbaria, with the word "type" indicated on the label. My own practice in the National Herbarium of New South Wales has been to mark a type by a label pasted on the specimen thus—

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* *Report A.A.A.S.* (Melbourne, 1900), p. 69.

TYPE

and I have been punctilious about putting ample information on the label. We Australians know to our cost how difficult systematic work has sometimes been through the easy-going ways of systematists who have preceded us. So long as they were alive they could indicate their own types, or believed they could, but in some cases they have passed away without leaving a sufficiently clear record, and botanical anarchy is sometimes the result. This matter of looseness of description of new plants is ably dealt with by Prof. B. L. Robinson in a recent Presidential Address,* which renders unnecessary some similar remarks I had prepared. I will only say that ample field notes should be attached to the specimen wherever possible. Let them be really field notes, that is to say, written in the field with the tree or other specimen in view, and with the impressions sharp. It is surprising how soon one's memory fails, and what a mine of information there often is in a field note, in a brief expression or form of words written down by a collector with little or no idea of the full meaning of his words, afterwards to be read in the light of ampler knowledge.

I have, in a disjointed way I fear, set before you some of the results of recent botanical activity which are of special interest to us, and I have indicated some of the work that requires to be done. Every line of research completed does but open out a vista which stretches into the boundless infinity of what remains to be achieved.

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* *Ov. cit.* p. 763.

> "I say that man was made to grow, not stop;
> That help, he needed once, and needs no more,
> Having grown but an inch by, is withdrawn :
> For he hath new deeds, and new helps to these.
> This imports solely, man should mount on each
> New height in view; the help whereby he mounts,
> The ladder-rung his foot has left; may fall,
> Since all things suffer change save God the Truth."
> ROBERT BROWNING, "A Death in the Desert."

In indicating, with such fulness, how vast are the fields of botanical science which remain untilled, I hope I shall not dishearten even the youngest member of our Society. Let the survey of the situation rather nerve us to fresh efforts, and let a stimulus be the memory of our noble-hearted founder whose beneficence to us should be recited at least every year at this annual gathering, as is the laudable practice of the University at its "commemoration" of benefactors.

Many of you can readily call to mind the happy, enthusiastic way in which Prof. Stephens, a former President, once uttered the words

FLOREAT SOCIETAS LINNEANA!

Perhaps there is a special appropriateness in that sincere wish for the welfare of our beloved Society being reiterated by a botanical President.

On the motion of Mr. R. H. Cambage a cordial vote of thanks was accorded to the President for his interesting Address.

The Hon. Treasurer presented the balance sheet for the year 1901, and moved its adoption, which was carried. The Society's income for the financial year ended December 31st, 1901, was £1,053 12s.; the expenditure £1,067 10s. 10d. (including one account for £17 12s. 6d. from 1900); with a credit balance of £15 7s. (including one cheque for £17 12s. 6d., not presented before 31st December, 1900) from the previous year, leaving a credit balance of £31 8s. 2d. The income of the Bacteriology Department was £586, and the expenditure £534 11s. 3d.; with a credit balance of £82 9s. 10d. from last year, leaving a credit balance of £133 18s. 7d.

On the motion of the Hon. Treasurer it was resolved that the suspension of the operation of Rule vi., providing for the payment of entrance fees, should be continued for all members nominated or elected during the year 1902.

No other nominations having been received, the President declared the following elections for the current session to have been duly made:—

PRESIDENT: J. H. Maiden, F.L.S., &c.

MEMBERS OF COUNCIL (to fill five vacancies): Professor T. W. E. David, B.A., F.R.S., Messrs. Henry Deane, M.A., F.L.S., M. Inst. C.E., &c., James R. Garland, M.A., James P. Hill, B.Sc., F.L.S., Prosper N. Trebeck, J.P.

AUDITORS: Messrs. Duncan Carson and Edward G. W. Palmer, J.P.

ENDOWMENT (CAPITAL).

	£	s.	d.		£	s.	d.
Amount received from Sir William Macleay during his life time	14,000	0	0	Loan A (secured by Mortgage)	3,000	0	0
Further Sum bequeathed by Will £6,000, less Probate Duty, £300	5,700	0	0	Loan B (secured by Mortgage)	5,000	0	0
				Loan (portion of Loan C, secured with other money by mortgage for £24,000,	11,700	0	0
	£19,700	0	0		£19,700	0	0

BACTERIOLOGY (CAPITAL).

	£	s.	d.		£	s.	d.
Legacy of £12,000, bequeathed by Sir William Macleay to the University of Sydney (less £600 probate duty), paid by the University into Court and ordered to be paid out to the Society	11,400	0	0	Loan (portion of Loan C)	11,400	0	0
Amount (out of interest received) ordered by the Council to be added to Principal	900	0	0	Also £900, from interest, included in Loan C	900	0	0
Further Amount (out of interest received) ordered by the Council to be added to Principal	700	0	0	Loan D	1,050	0	0
Interest received, ordered by the Council to be invested	350	0	0				
	£13,350	0	0		£13,350	0	0

Febuary 11th, 1902.

Audited and found correct. We have also seen the securities.

Linnean Society of New South Wales.

BALANCE SHEET.

INCOME, 1901.

Dr.

	£	s.	d.
1901, Jan. 1.			
To Balance from 1900	45	7	0
,, Cash in hand	1	0	0
,, Subscriptions	123	18	0
,, Sales (including 100 copies of Proceedings purchased by the Government)	118	10	2
,, Interest	775	10	0
,, Exchanges...	0	3	6
,, Bacteriology Account—two years' Contribution to Rates and Insurance ...	31	12	10
,, Cost of extra copies of Bacteriological Papers...	2	17	6
	£1,098	19	0

Cr.

	£	s.	d.
By Postage and Duty Stamps, and Petty Cash (Hon. Treasurer)	2	0	0
,, Ground Rent and Land Tax	67	2	11
,, Municipal and Water & Sewerage Rates	18	10	4
,, Insurance	7	13	10
,, Telephone	9	0	0
,, Printing and Stationery	292	3	2
,, Plates and Illustrations	113	3	9
,, Salaries and Wages	478	0	0
,, Petty Cash (Secretary) including—Advertisements, Postage, Refreshments and Attendance, Sundries ...	30	0	0
,, Purchase of Books	16	0	6
,, Bacteriology A/c – Interest received in 1900 and credited to General A/c ...	21	0	0
,, Do.—Fees received in 1900 and credited to General A/c	11	10	0
,, Bank Fee, 10s.; Exchange and Cheque Book, 16s. 4d.	1	6	4
Dec. 31.—Balance	31	8	2
	£1,098	19	0

February 11th, 1902.

Audited and found correct,

E. G. W. PALMER, }
DUNCAN CARSON, } Auditors.

J. R. GARLAND, Hon, Treasurer,

BACTERIOLOGY ACCOUNT.

INCOME, 1901.

		£	s.	d.		£	s.	d
1901, Jan. 1.					1901.			
To Balance in Bank	£83 18 0				By Journals and Books	14	17	8
Less Cheque not presented	1 8 10				,, Salaries and Wages	426	0	0
		82	9	10	,, Petty Cash	12	0	0
,, Interest		534	0	0	,, Apparatus and Chemicals	25	9	0
,, General Account for Interest received in 1900 and credited to General A/c.		21	0	0	,, Gas	6	6	0
,, Do.—Bacteriology Fees, do., do. ..		11	10	0	,, Bacteriologist's share of Fees	13	0	2
,, Bacteriology Fees (1901)		19	10	0	,, Two years' contribution to Rates, Insurance, &c.	31	12	10
					,, Shipping Charges, &c.	1	18	1
					,, Cost of extra copies of Papers	2	17	6
					,, Bank Fee	0	10	0
					Dec. 31.—Balance	133	18	7
		£668	9	10		£668	9	10

February 11th, 1902.

Audited and found correct.

E. G. W. Palmer, } Auditors.
Duncan Carson, }

J. R. Garland, Hon. Treasurer.

CONCLUSION OF THE ADDRESS

Delivered by the Hon. James Norton (then President) on 27th March, 1901, and now substituted for the last three paragraphs published in page 794, Part 4, of the Proceedings for the year 1900.

HOBART.

At a meeting held at Government House on 14th October, 1843, the members of the Tasmanian and Horticultural Societies and other gentlemen determined to form a garden, to be under the care of the Royal Society. The Governor subsequently assigned to the Society, for that purpose, a large portion of the Government House grounds; and on 12th September, 1844, announced that Her Majesty Queen Victoria had signified her consent to become Patroness of the Society, under the designation of "The Royal Society of Van Diemen's Land for Horticulture, Botany and the Advancement of Science."

In 1847 Mr. F. W. Newman, of Sydney, was appointed manager, and, after a short interim appointment of the Rev. Dr. Lillie, Dr. Milligan was appointed Secretary in 1848; he remained in office until 1860. After another interim appointment of the Hon. W. Archer, the late Sir James (then Dr.) Agnew was elected in 1861, and he remained in office till 1885, when the present Secretary, Mr. Alexander Morton, took his place.

Mr. Newman died in 1859, and was succeeded by Mr. F. Abbott, who had been employed under him and is now in office.

In 1885 the gardens, together with the Museum, were placed by Act of Parliament under a Board of official and other Trustees and endowed with £800 a year, with liberty to supplement the same by the sale of plants and flowers, but comparatively little work has been done for want of space and funds.

The area of the gardens, which are situated on the bank of the River Derwent and adjoin the Government House grounds, is about 20 acres, and they are kept in order by the labour of seven men, supplemented from time to time by prison labour. Musical band performances are permitted on Sundays.

PERTH.

The Government Botanical Garden of Perth adjoins the beautiful Government House Domain. Its area is comparatively small, but the Curator, Mr. Daniel Feakes, under whose control the garden was placed in 1887, is also charged with the management of other Government gardens and of various parks and reserves.

To this gentleman's zeal and untiring energy the beauty and the present state of perfection which the garden has attained appear to be mainly due.

After making allowance for its youth, it bears very favourable comparison with other gardens of the same character, and it is to be hoped that the wondrous indigenous floral wealth of the State of Western Australia will encourage the cultivation of the many strange and beautiful plants which the growth of civilization has so unfortunate a tendency to destroy.

The late Baron von Mueller was up to the time of his death (in 1890) Consulting Botanist to the State, and was succeeded by Mr. Fred. Turner, of Sydney. Dr. A. Morrison is Botanist to the Bureau of Agriculture.

SYDNEY.

Mem.—The area of the Sydney Botanical Gardens has, since the disastrous Garden Palace fire, been increased to 190 acres.

[Printed off May 15th, 1902.]

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(1901.)

The generic names of Tate and May's "Revised Census of the Marine Mollusca of Tasmania" are not included, as they are indexed separately (pp. 467-471).

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  cytisoides 79
  granulata *var.* adenodonta 80
  lævigata *var.* laxiflora ... 80
  Smithii 79
    var. Fraseri 79
Zoopsis argentea 634
Zygopetalum 791

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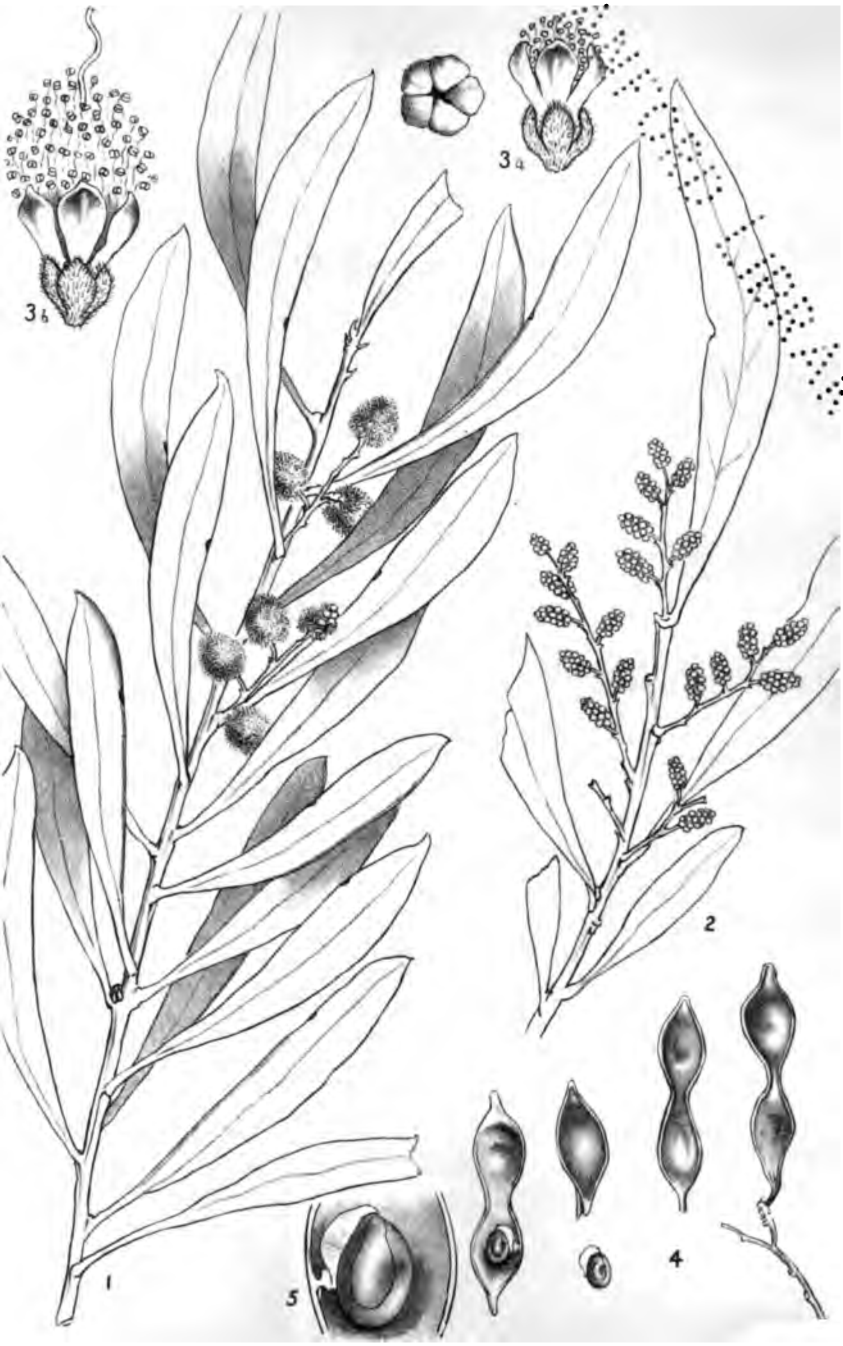
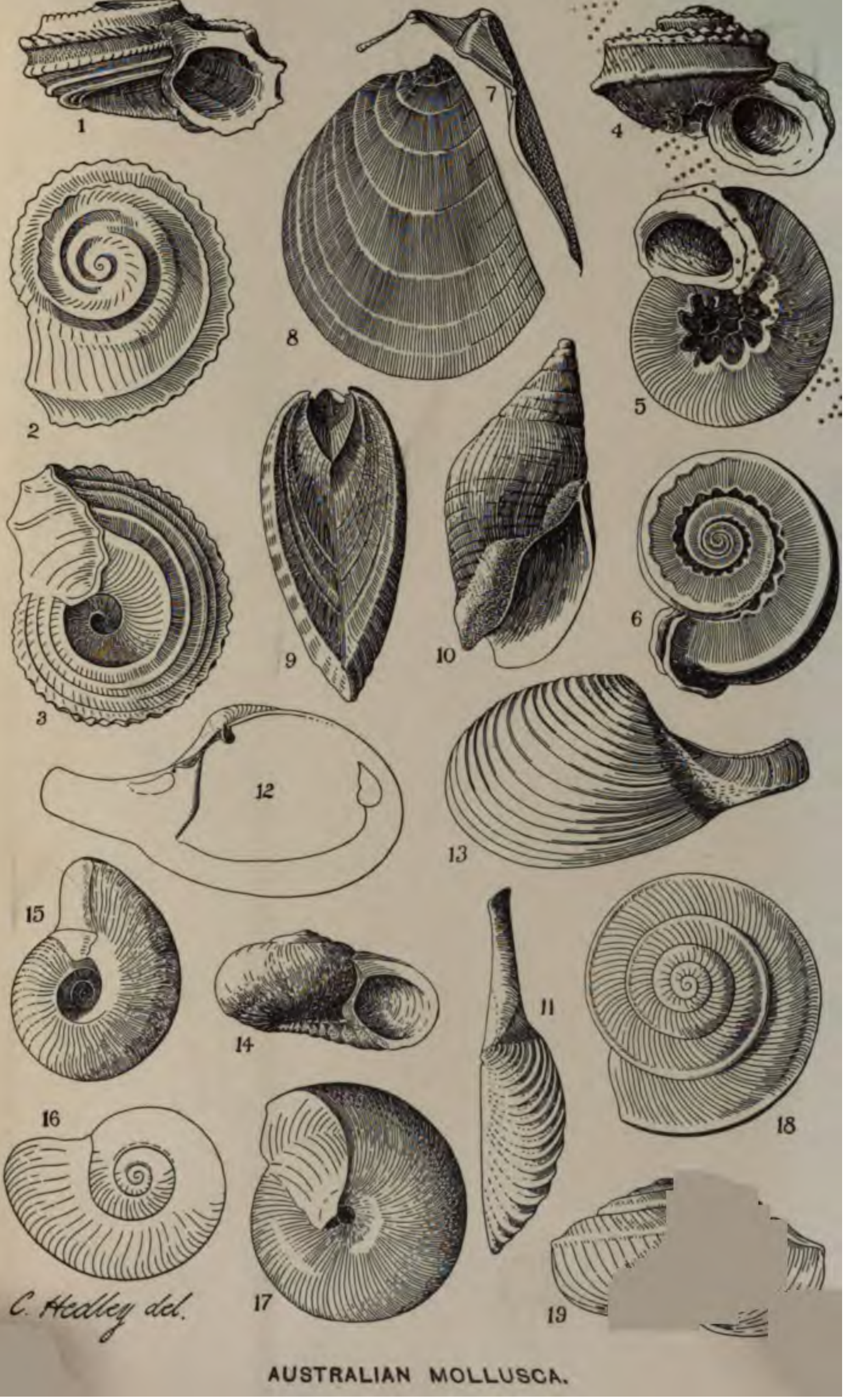


ACACIA DOROTHEA. *n.sp.*



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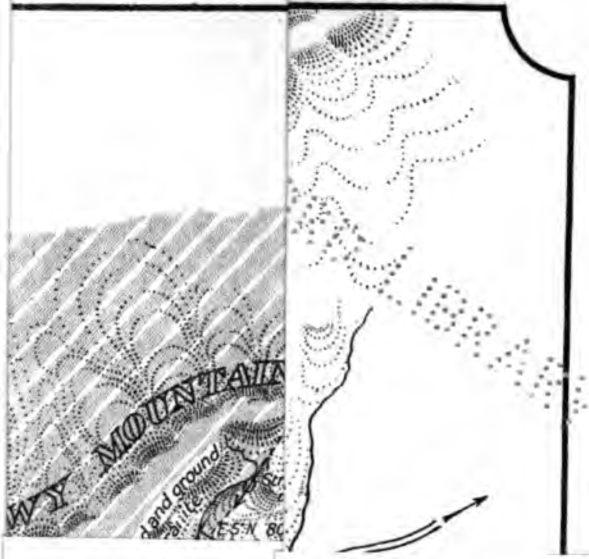
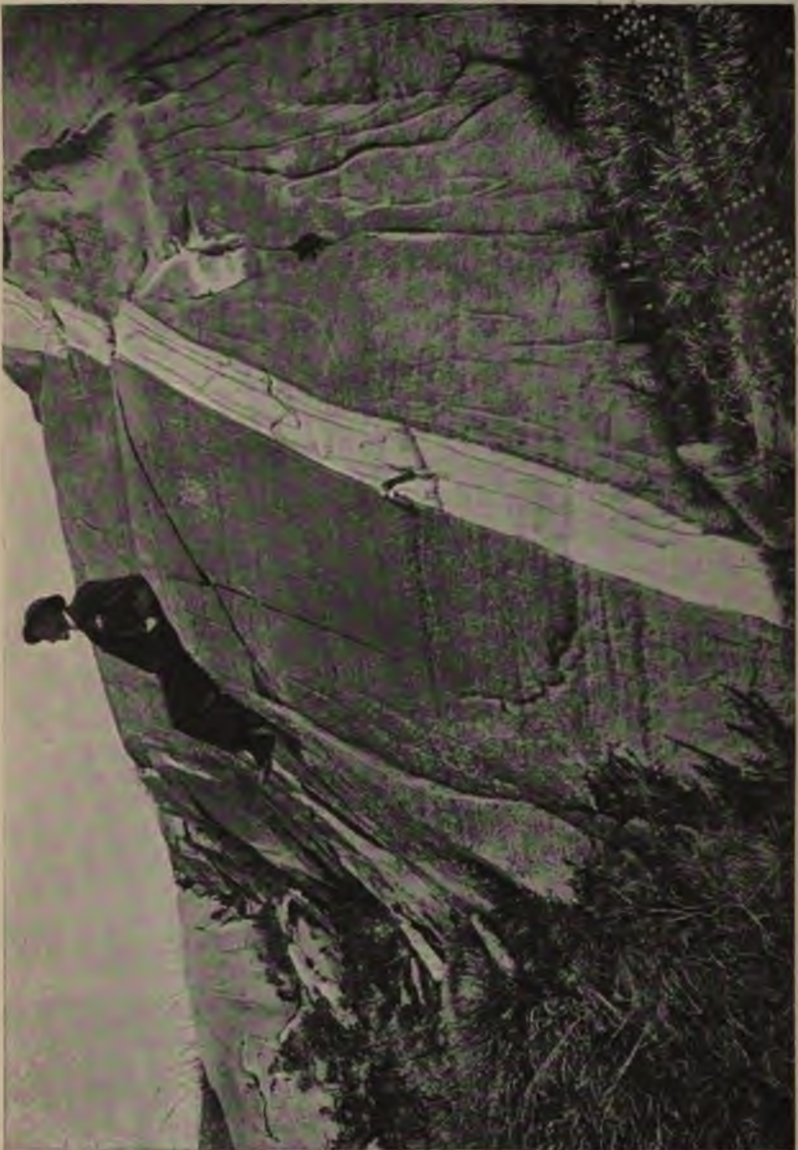
Pl. III





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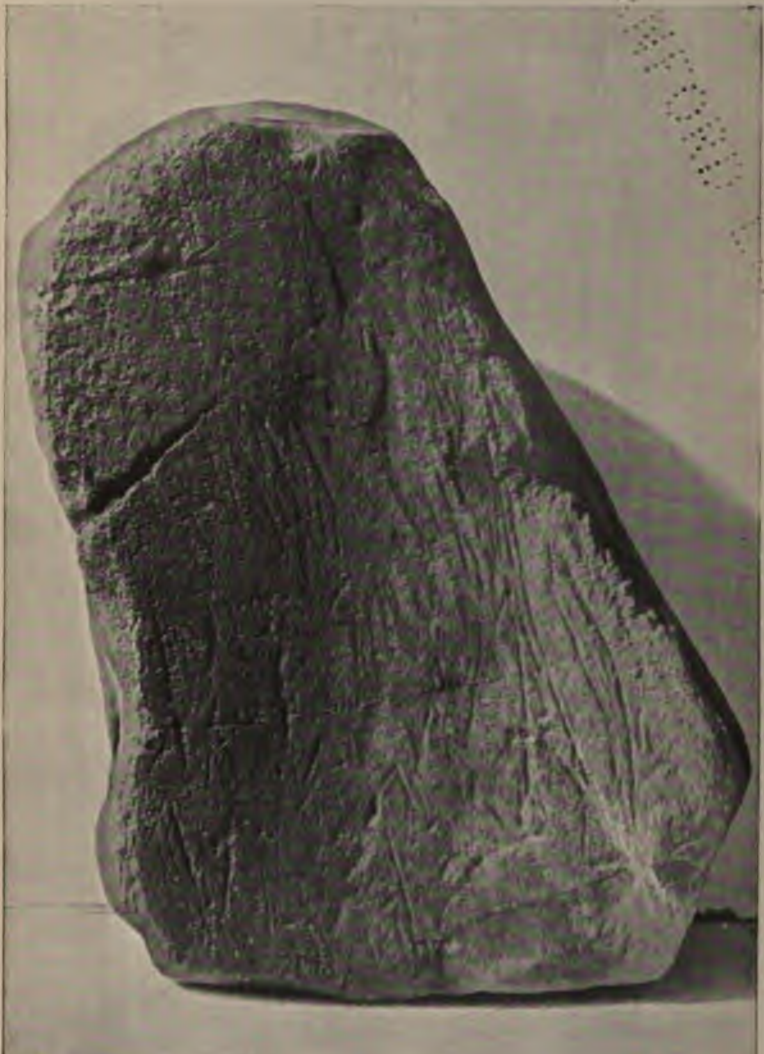
ROCHE MOUTONNEE OF GNEISSIC GRANITE.



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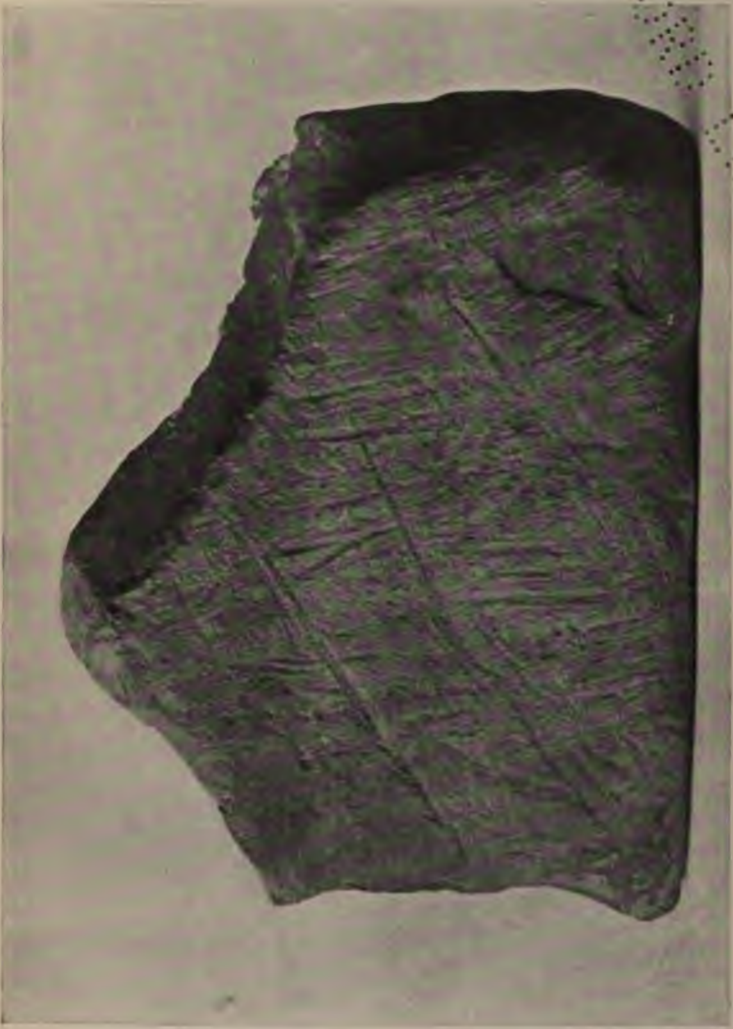
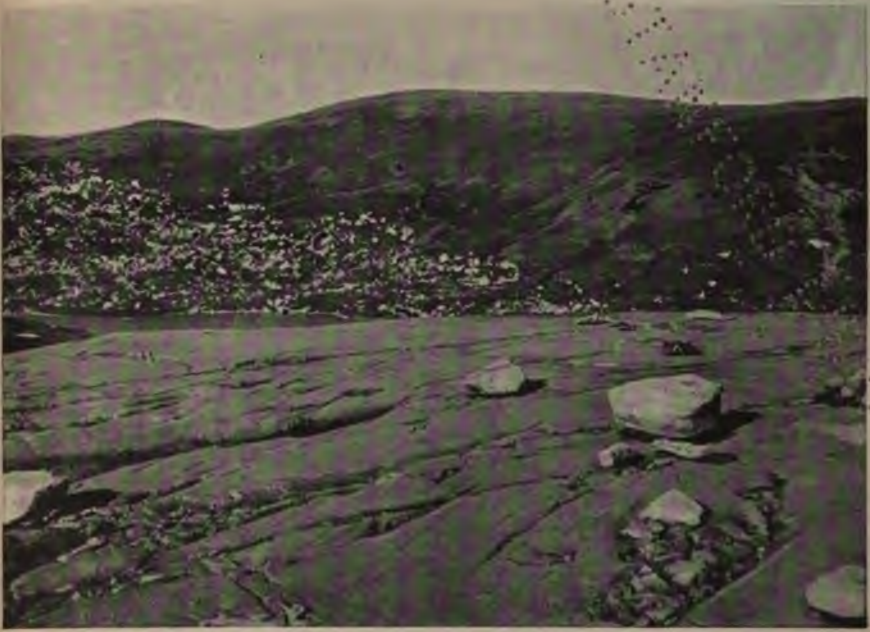
STRIATED BOULDER OF QUARTZITE.



GROOVED AND STRIATED BOULDER OF QUARTZITE.



GROOVED PAVEMENT OF GNEISSIC GRANITE ; LAKE ALBINA, KOSCIUSKO ; AND LARGE STRANDED GRANITE ERRATICS IN THE BACKGROUND.

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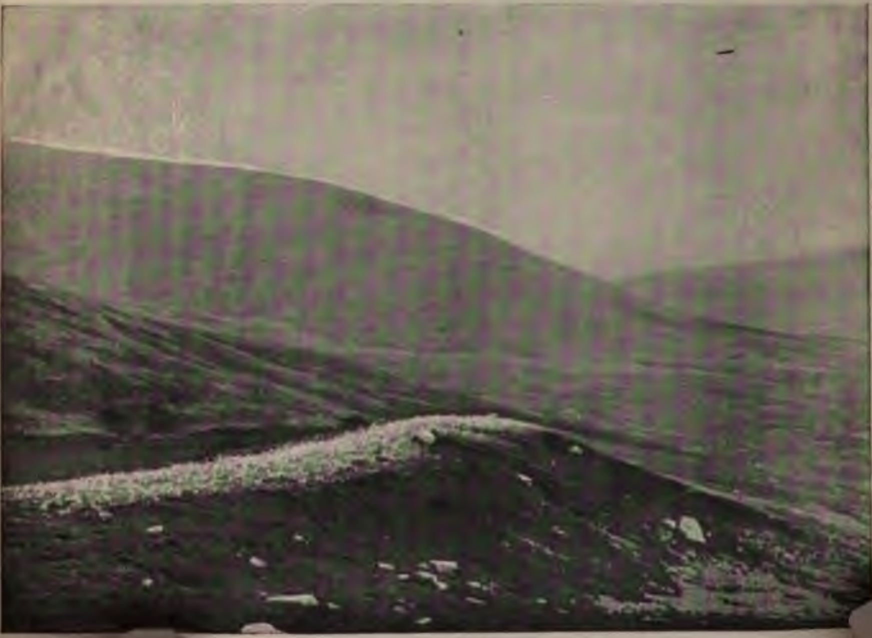

RELIC OF A LATERAL MORAINE NEAR TOWNSEND'S PASS KOSCIUSKO.

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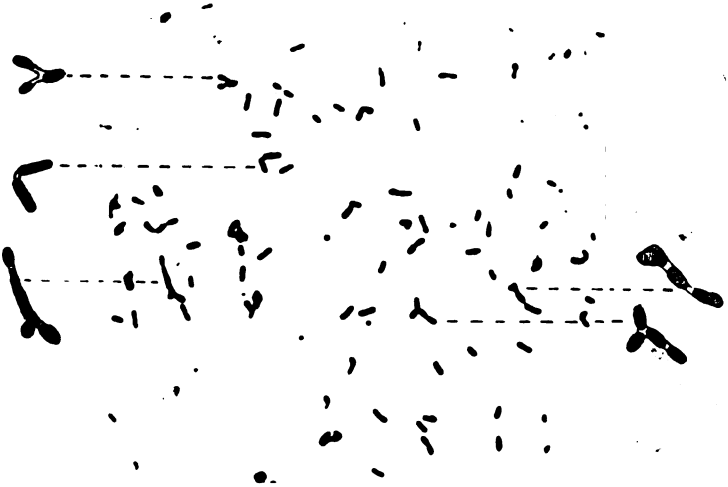
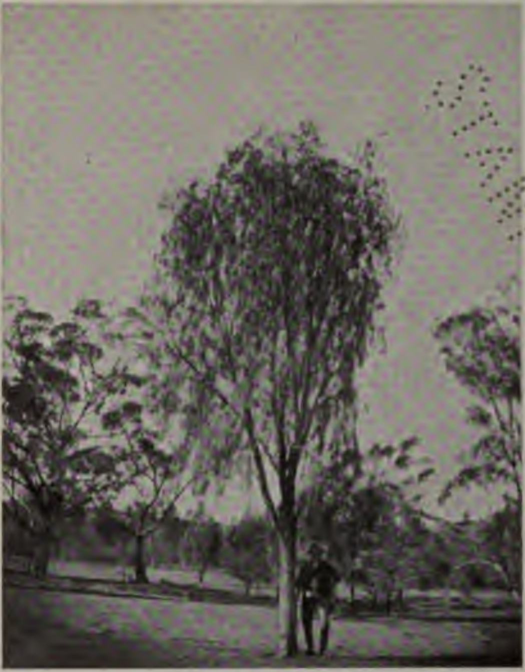


VIBRIO (MYCOBACTERIUM) DENITRIFICANS.



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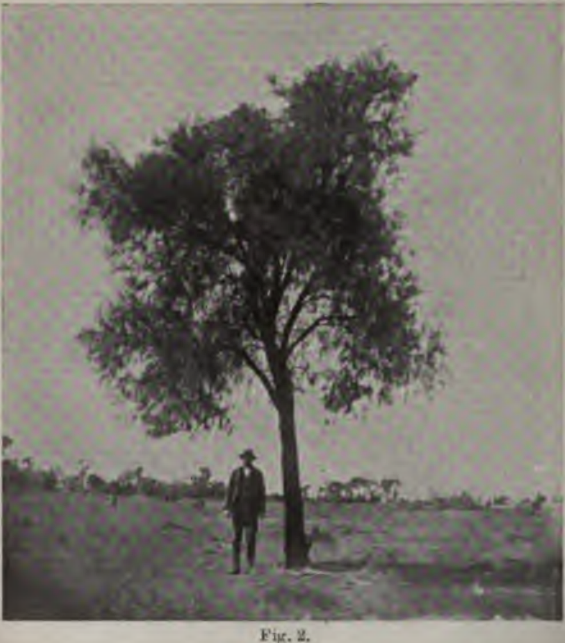
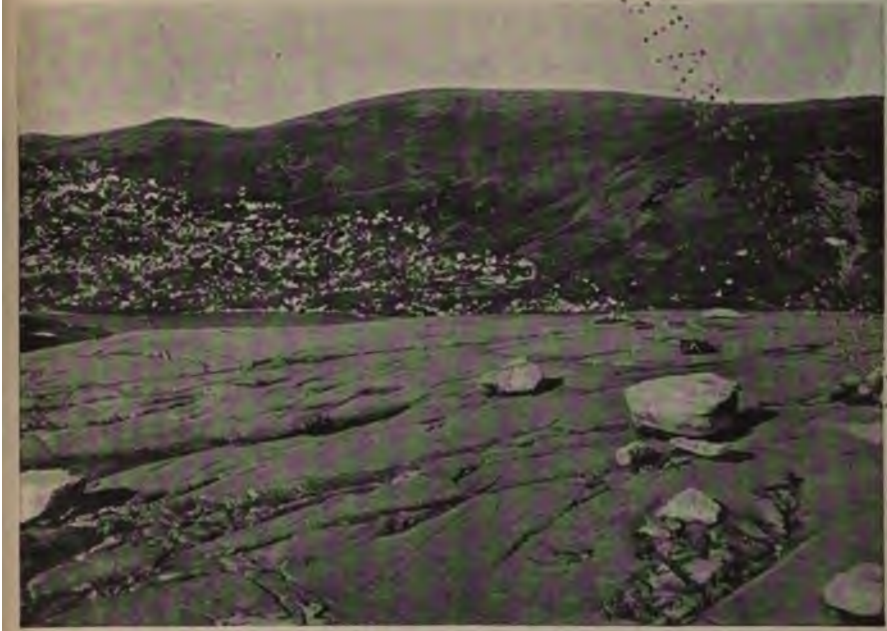


Fig. 2.

Fig. 1. PITTOSPORUM PHILLYRÆOIDES, *DC.* Fig. 2. EREMOPHILA LONGIFOLIA, F.v.M.



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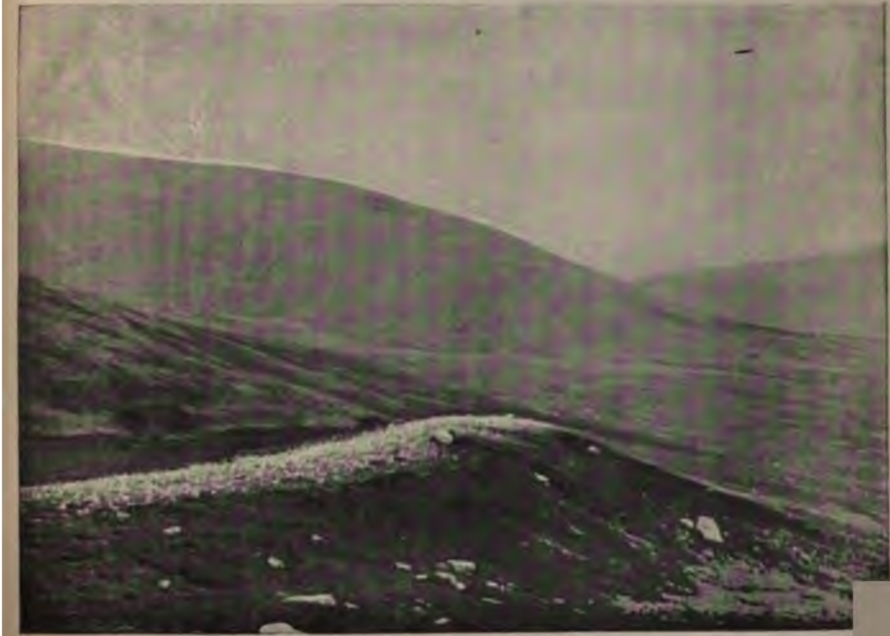
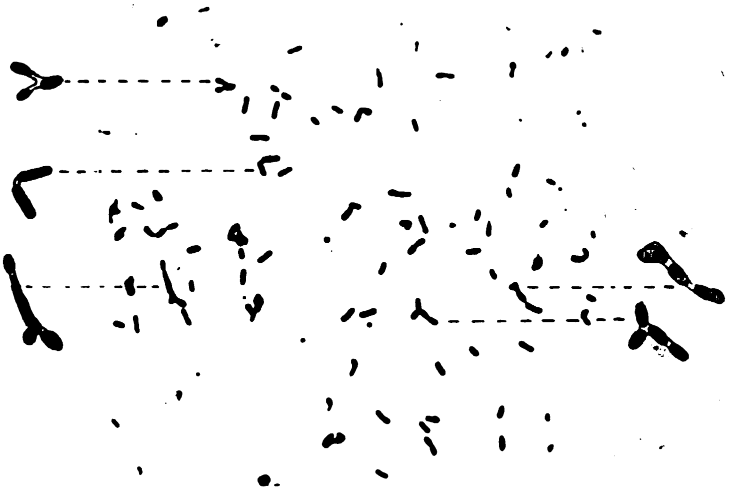


RELIC OF A LATERAL MORAINE NEAR TOWNSEND'S PASS KOSCIUSKO.

PHOTO, T. W. E. DAVID.



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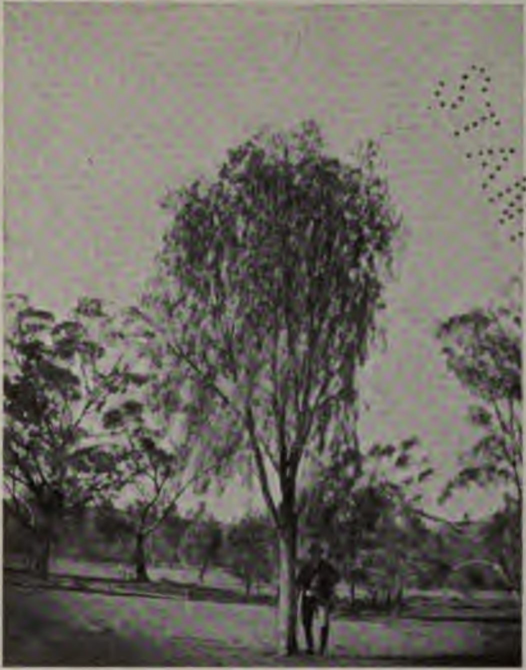

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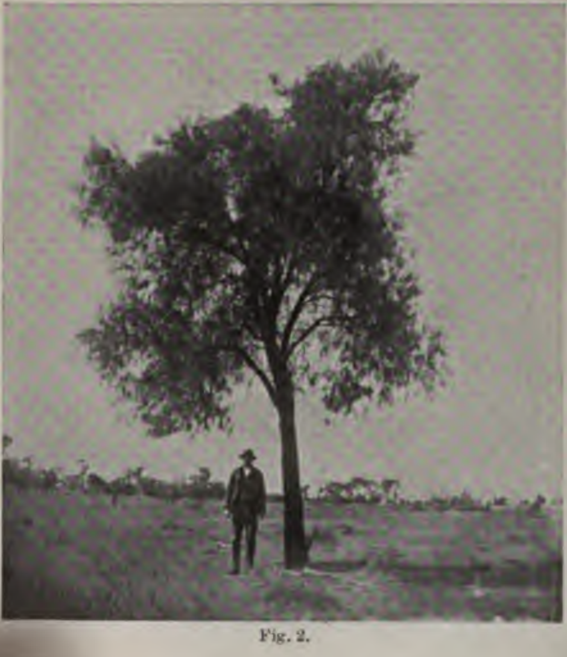

Fig. 2.

JM PHILLYRÆOIDES, DC.   FIG. 2. EREMOPHILA LONGIFOLIA F.

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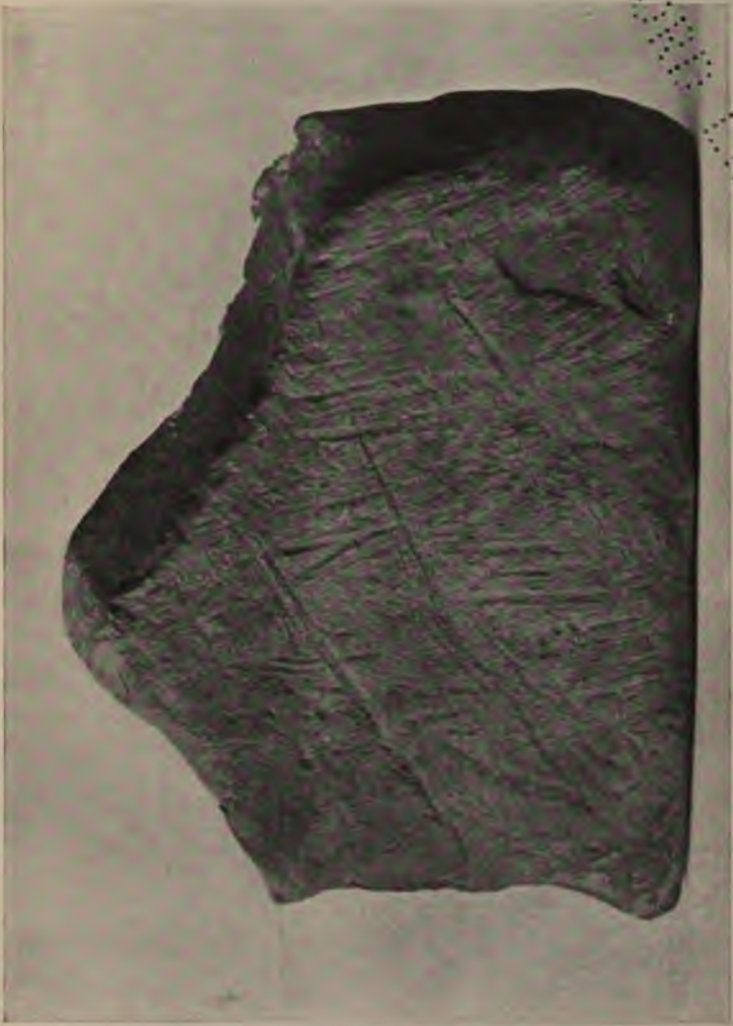

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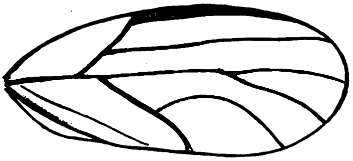

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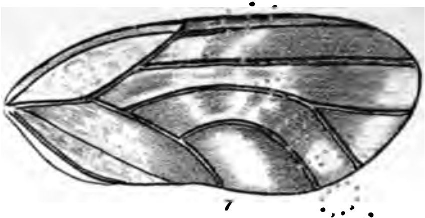

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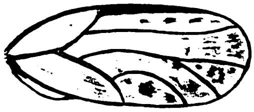

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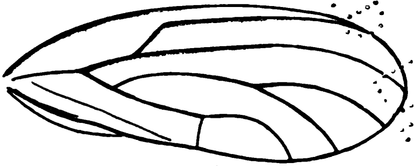

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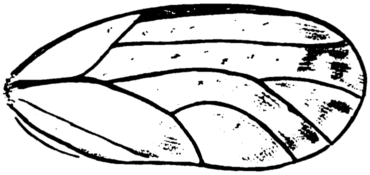

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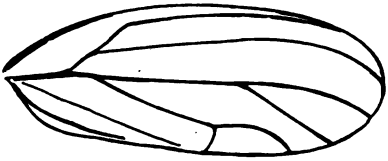

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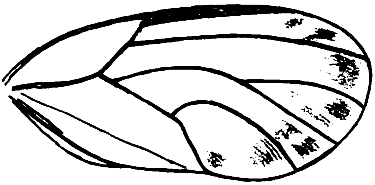

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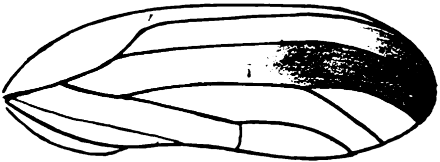

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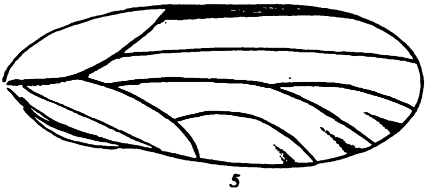

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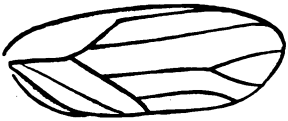

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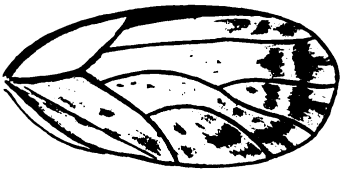

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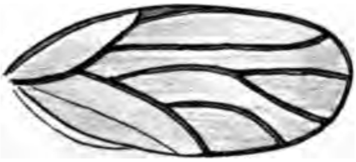

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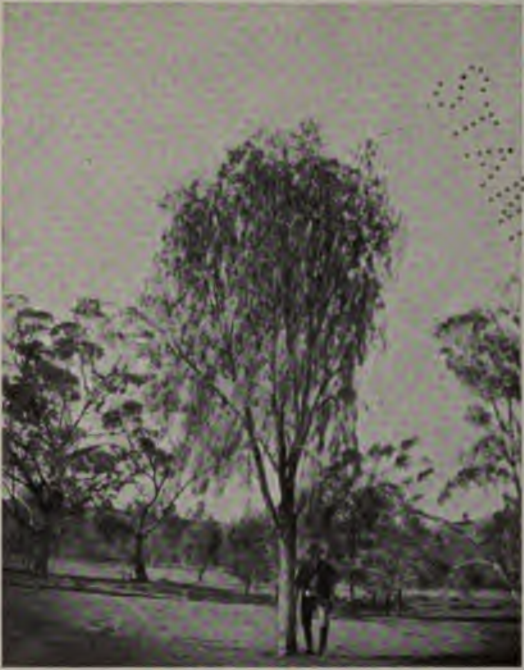

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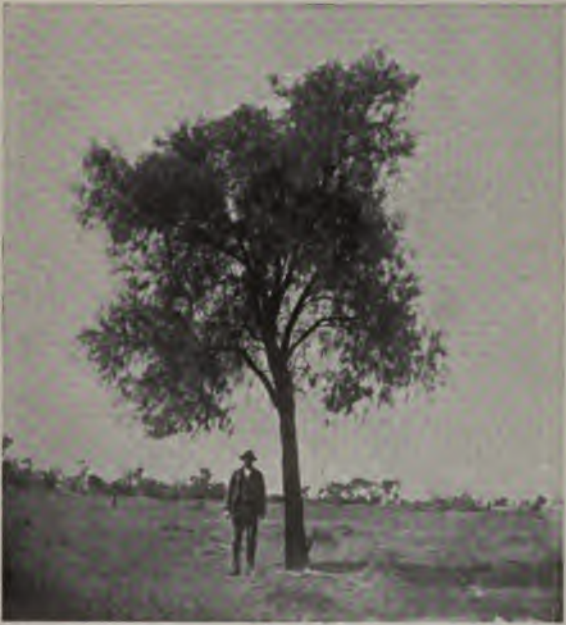

Fig. 2.

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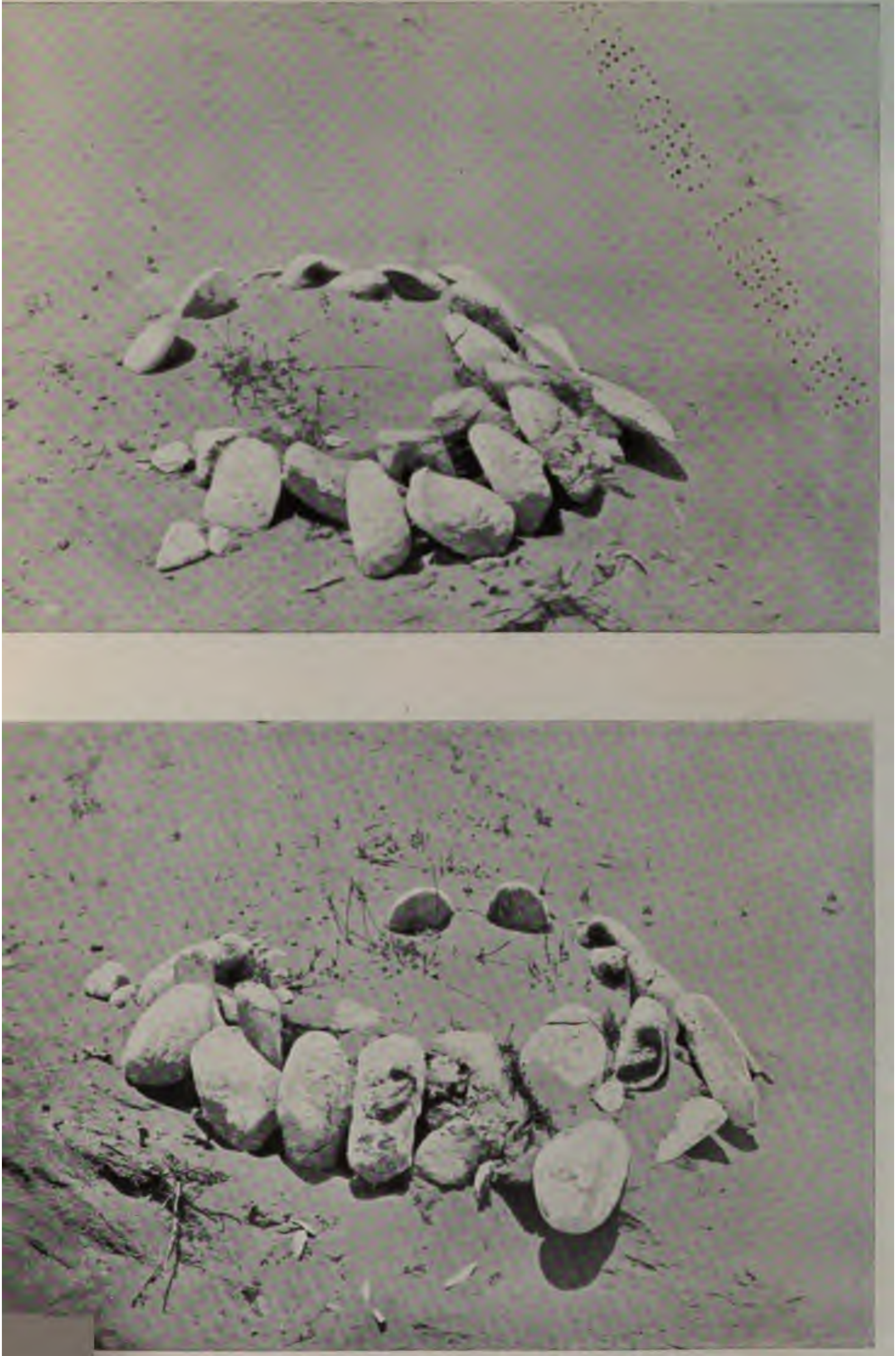
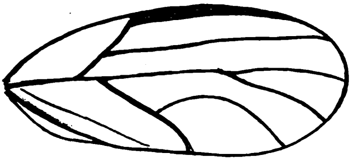


AUSTRALIAN ABORIGINAL GRAVE, DARLING RIVER DISTRICT, N.S.W.



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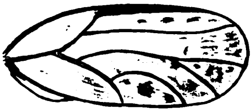

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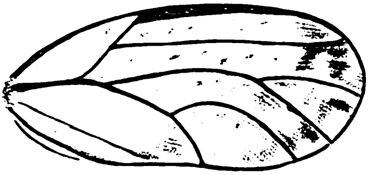

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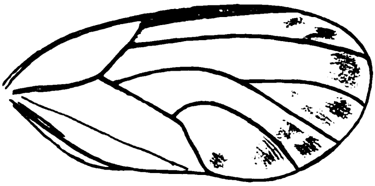

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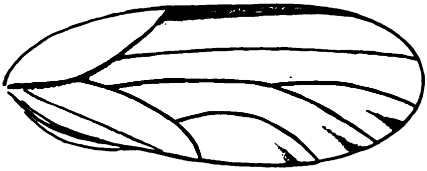

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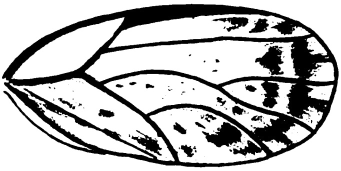

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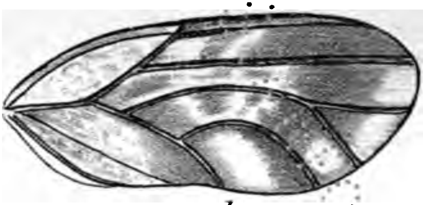

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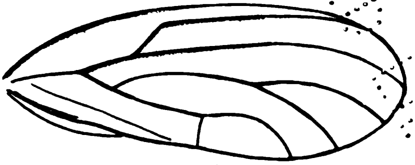

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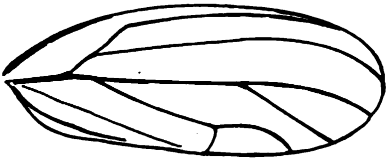

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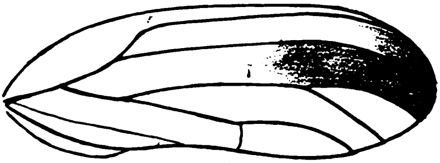

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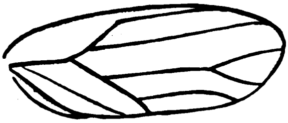

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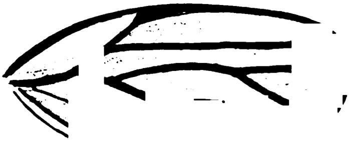

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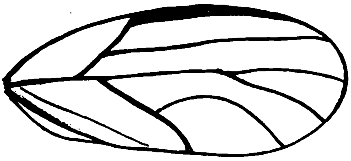

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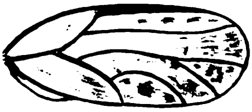

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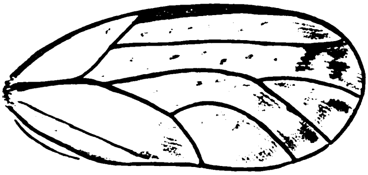

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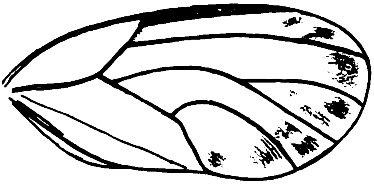

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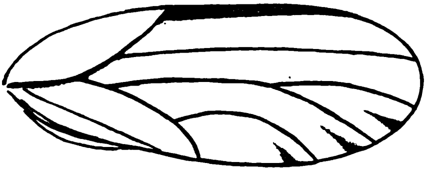

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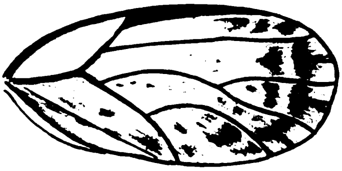

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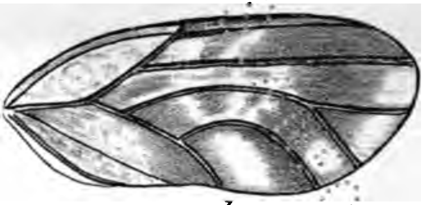

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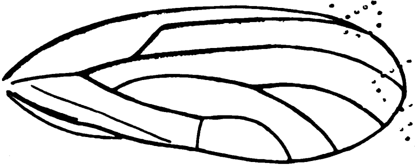

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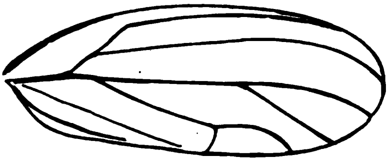

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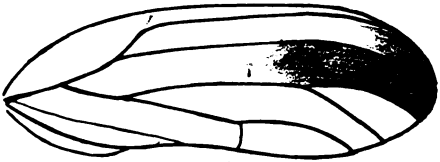

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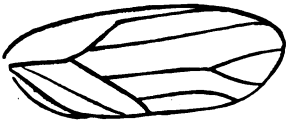

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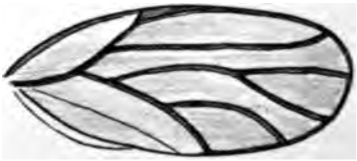

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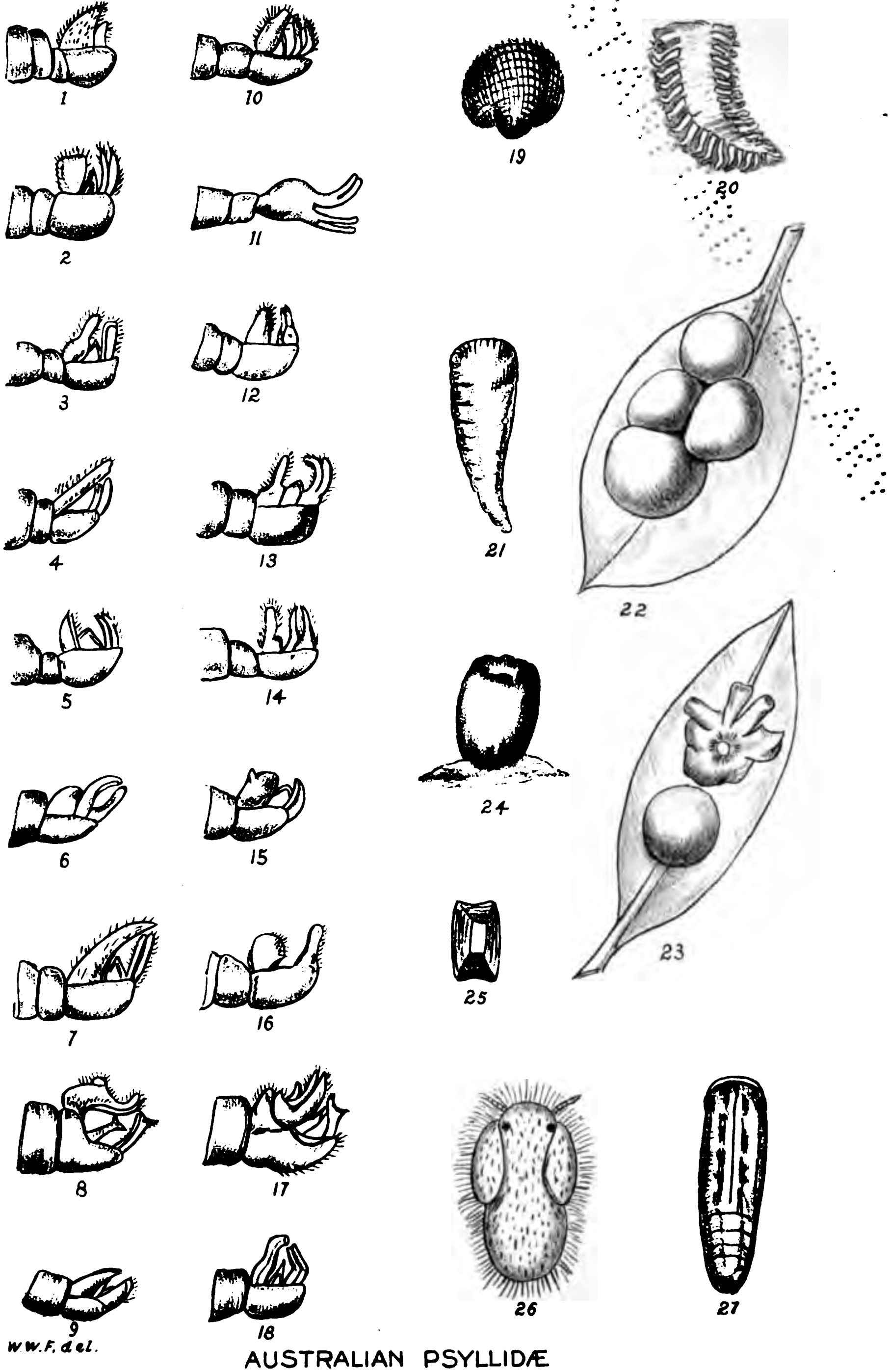

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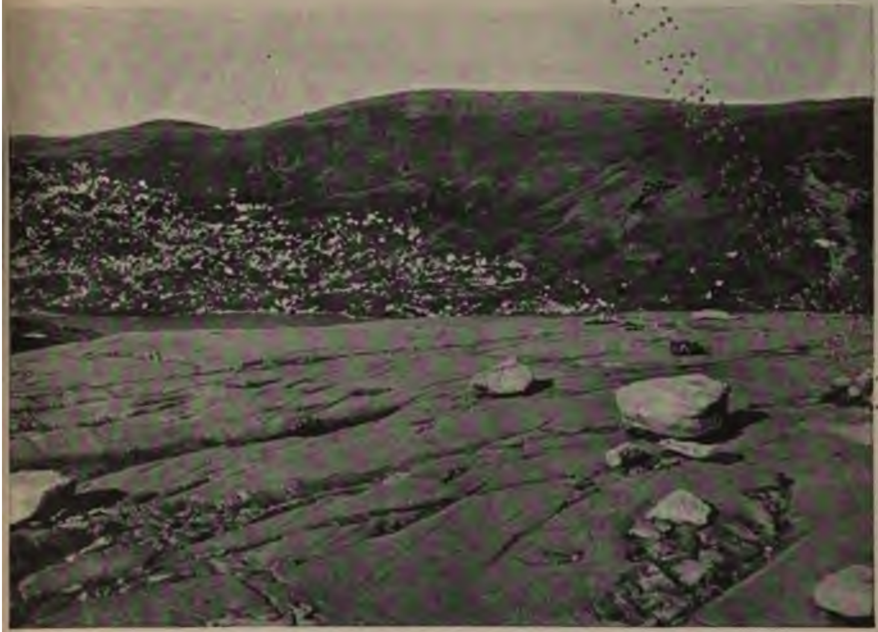

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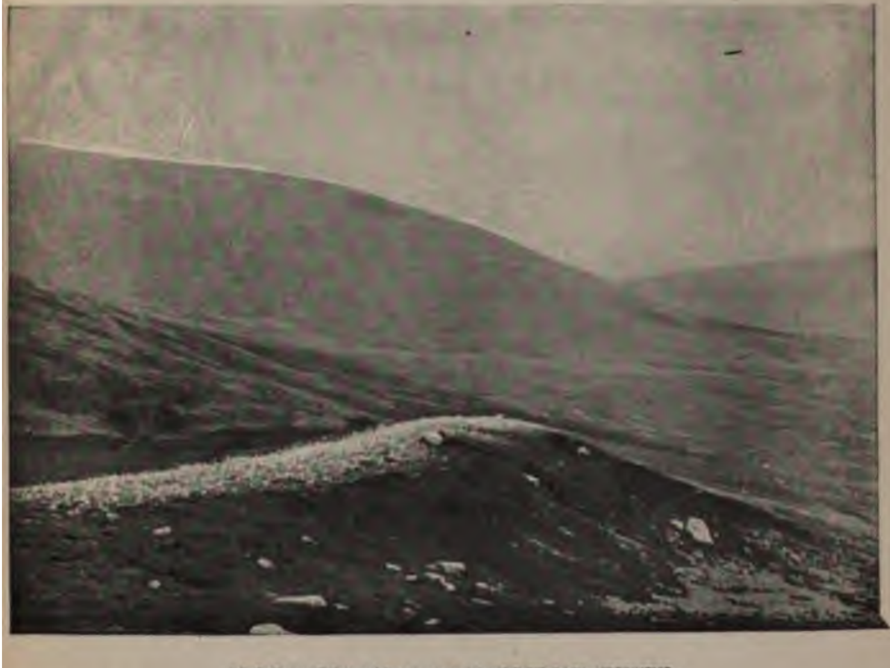
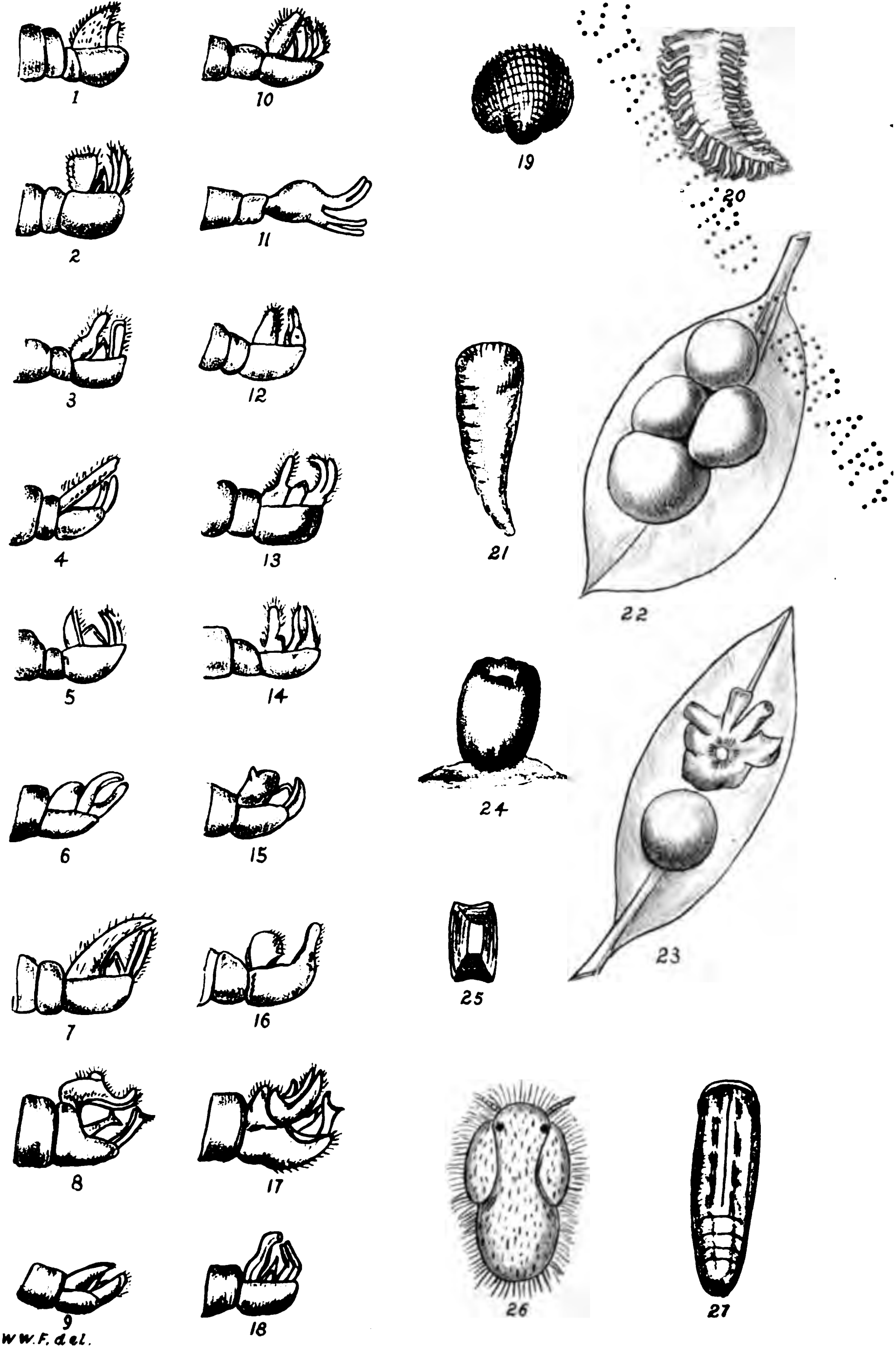
PHOTO, E. F. PITTMAN.



RELIC OF A LATERAL MORAINE NEAR TOWNSEND'S PASS KOSCIUSKO.

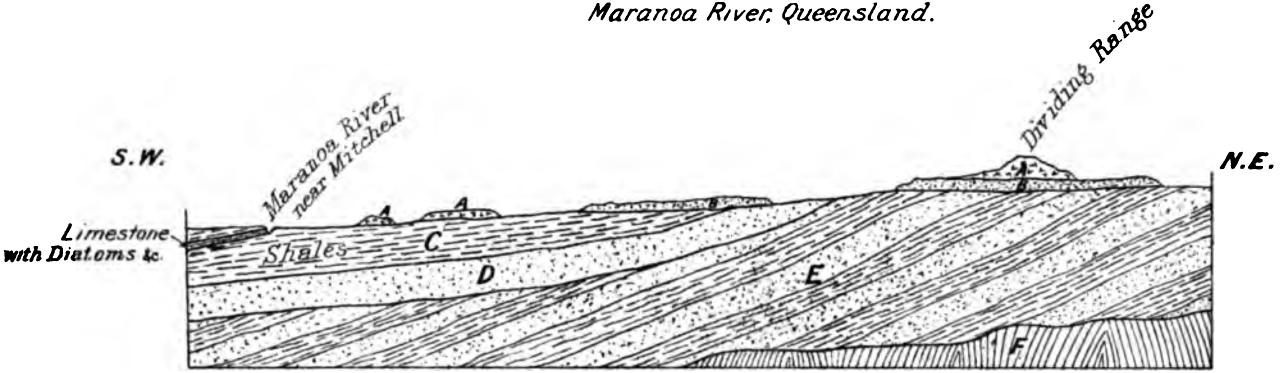
PHOTO, T. W. E. DAVID.

P.L.S.N.S.W. 1901. Pl. XVI



AUSTRALIAN PSYLLIDÆ

Section showing the horizon of Lower Cretaceous
Limestone containing Diatoms, Radiolaria and Infusoria.
Maranoa River, Queensland.



A. Basalt. **B**. Desert Sandstone. **C**. Rolling Downs Beds. **D**. Blythesdale Braystone.
E. Ipswich Beds. **F**. Palaeozoic (Gympie)

Horizontal Scale 8 Miles to an Inch.

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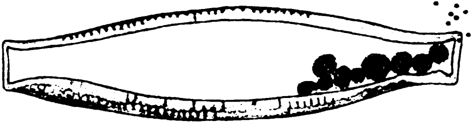

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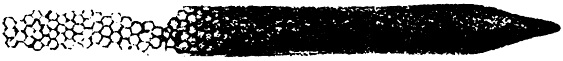

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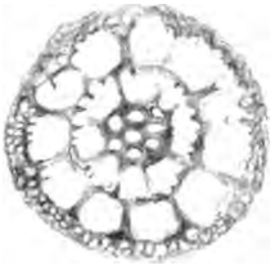

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T.W.E.D. del.

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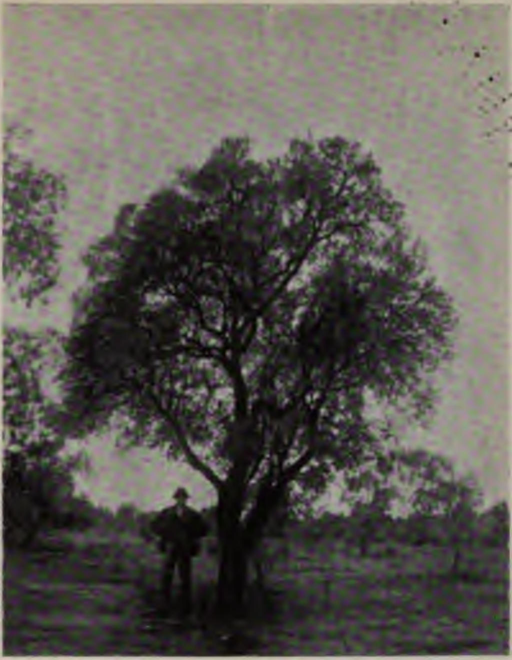

Fig. 1.

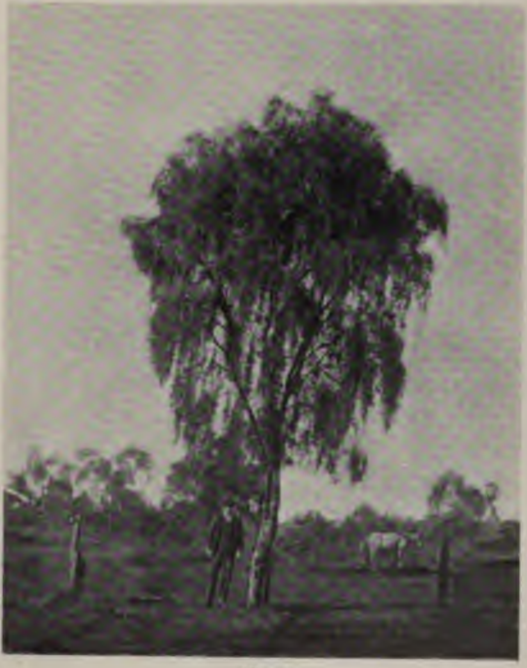

Fig. 2.

Fig. 1. CAPPARIS MITCHELLI, *Lindl.* Fig. 2. FLINDERSIA MACULOSA, F.v.M.

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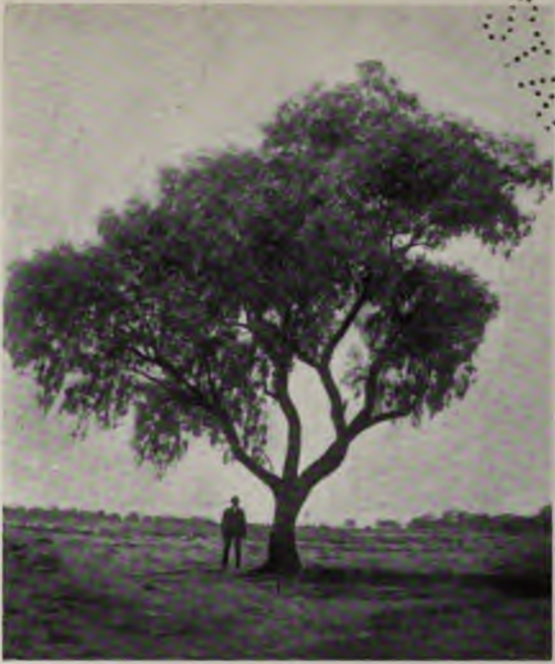


Fig. 3.

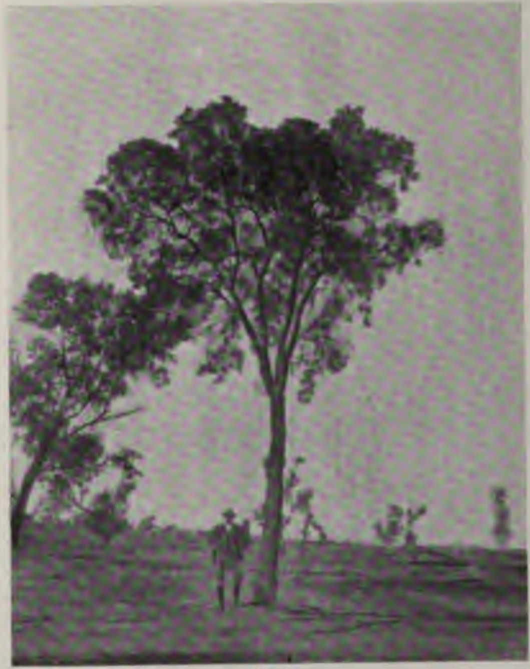
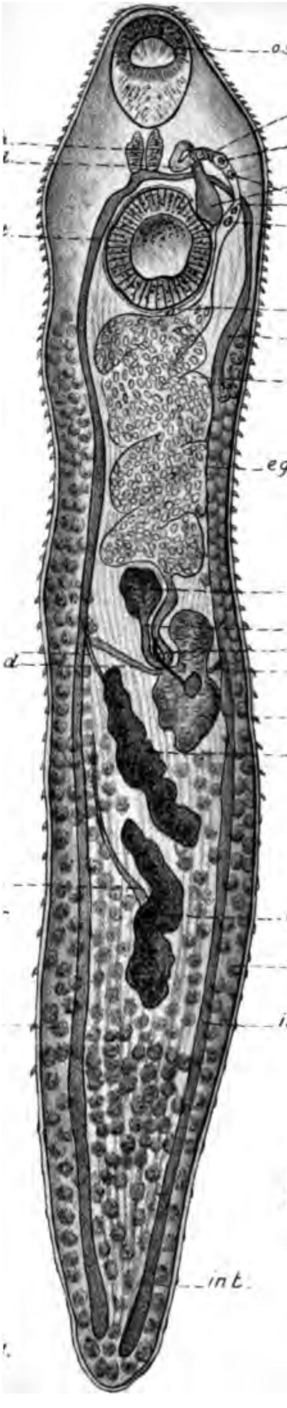
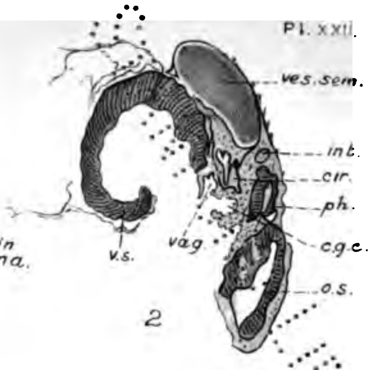


Fig. 4.

Fig. 3. EUCALYPTUS MICROTHECA, *F.v.M.* Fig. 4. ATALAYA HEMIGLAUCA, F.v.M.





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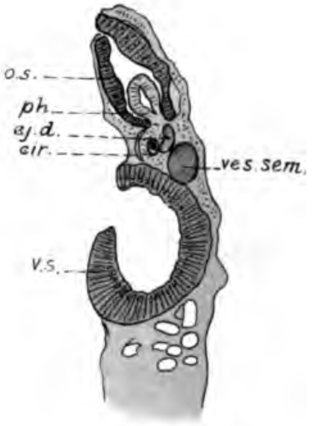

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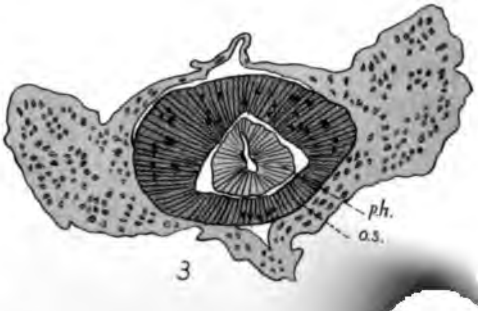

3

DISTOMUM ORNITHORHYNCHI, *n. sp.*

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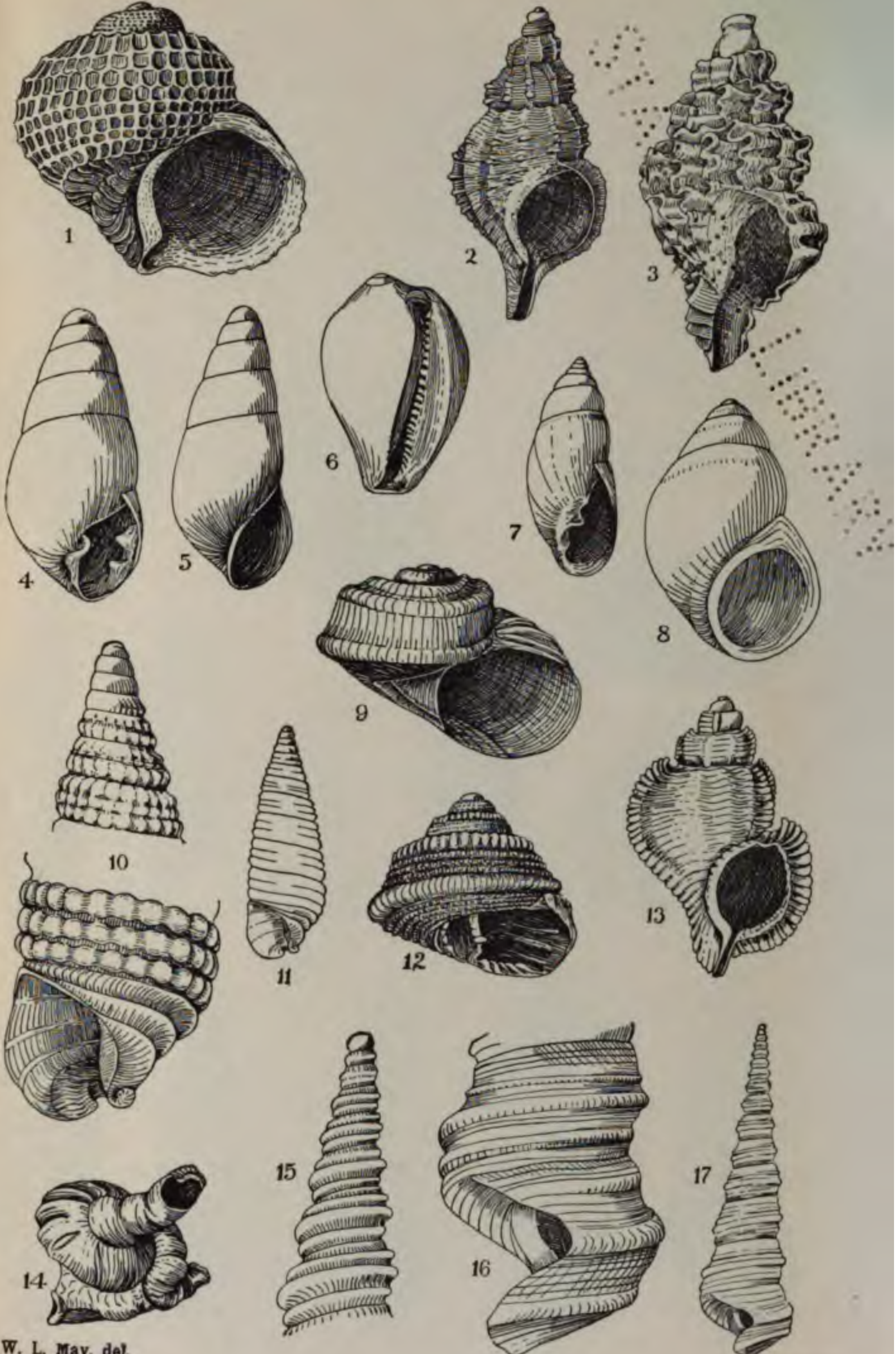

W. L. May, del.

TASMANIAN MOLLUSCA.

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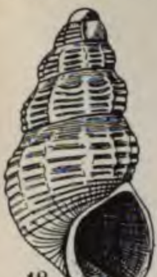

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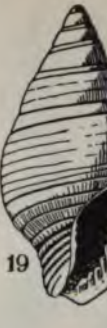

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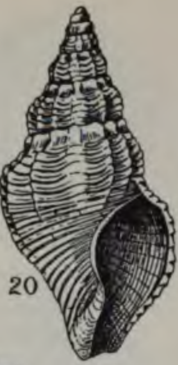

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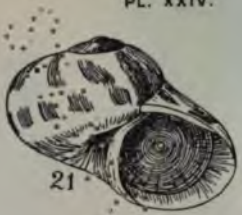

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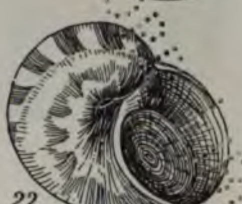

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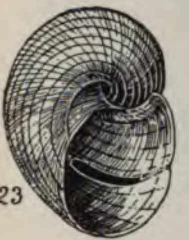

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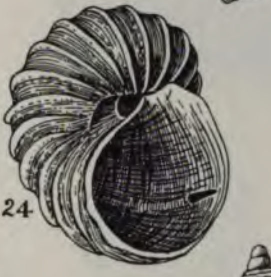

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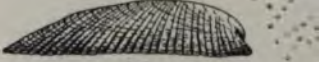

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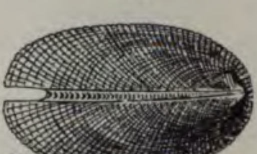

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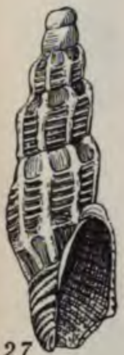

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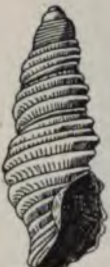

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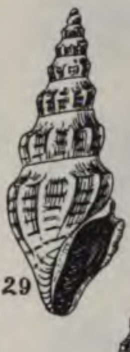

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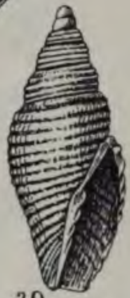

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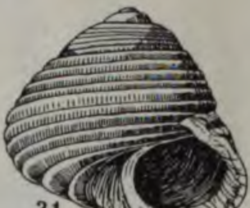

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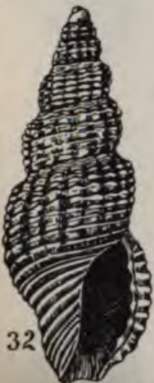

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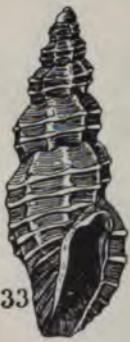

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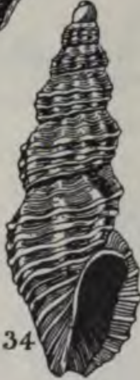

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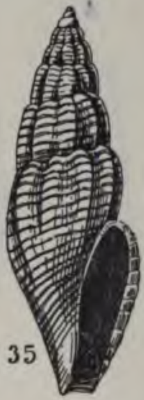

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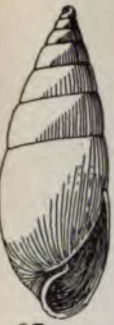
W. L. May, del.

TASMANIAN MOLLUSCA.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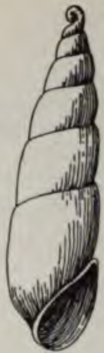
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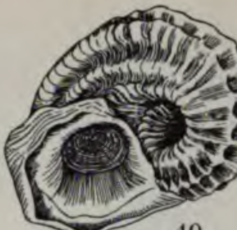
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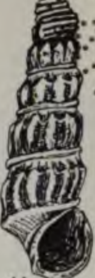
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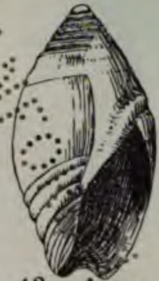
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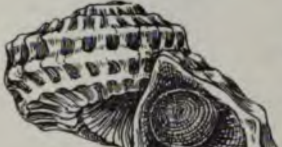
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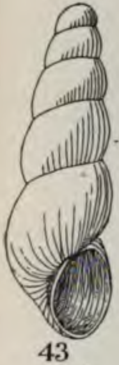
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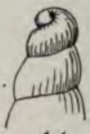
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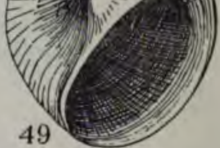
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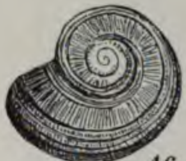
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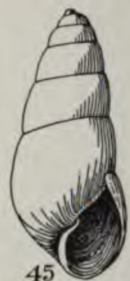
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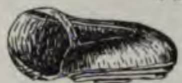
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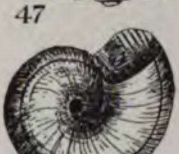
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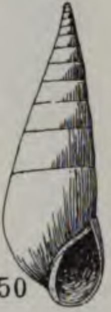
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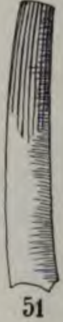
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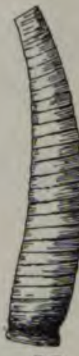
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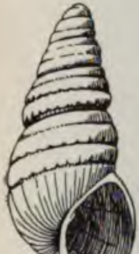
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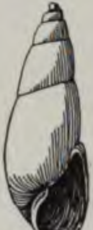
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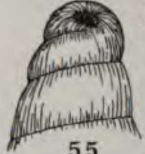
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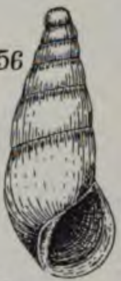
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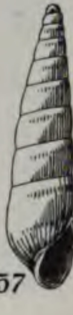
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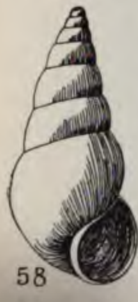
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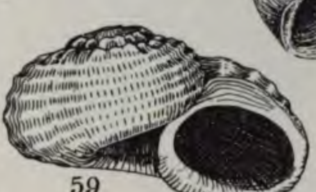
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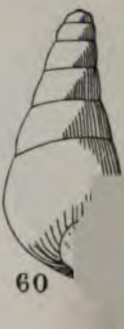
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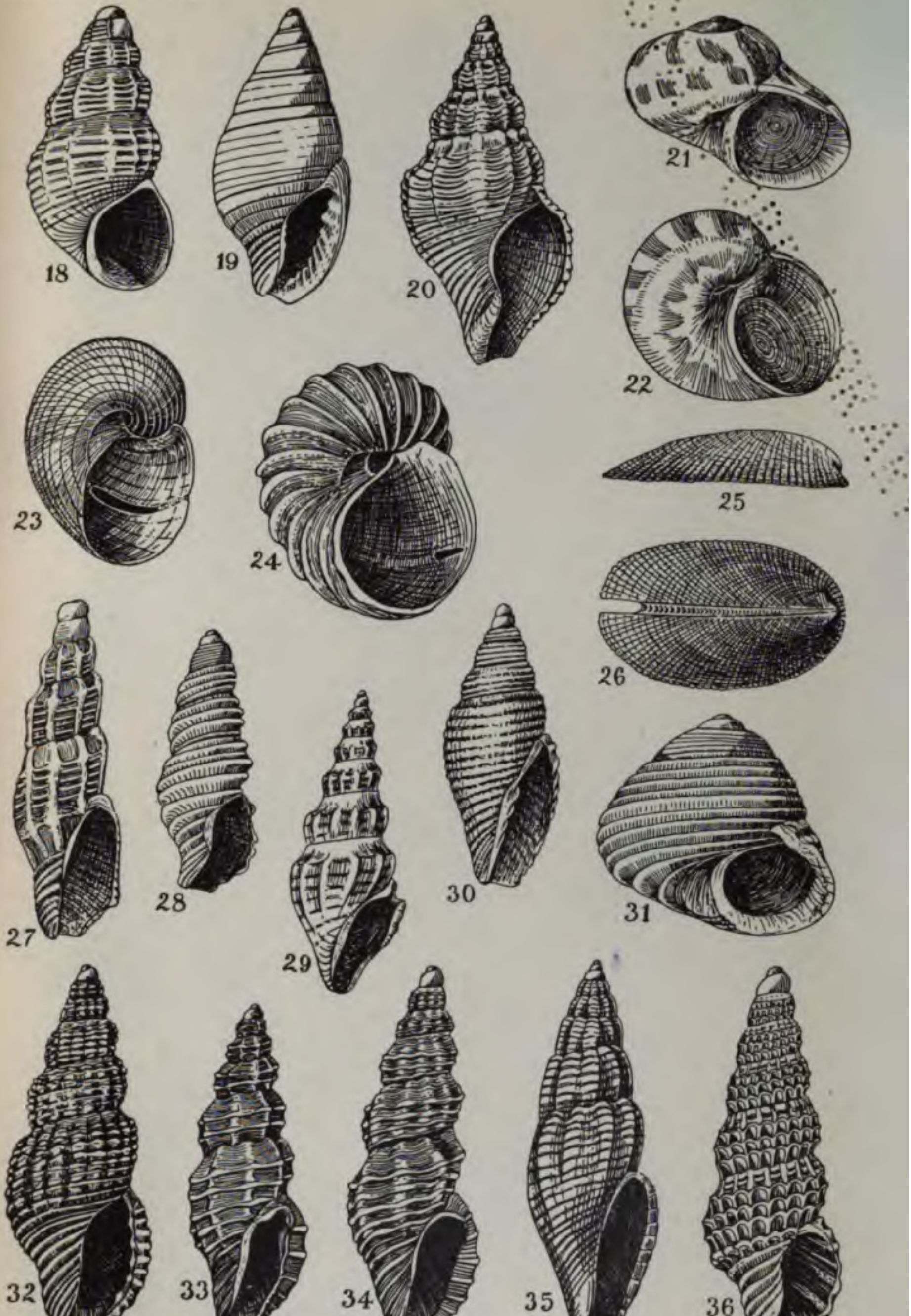
TASMANIAN MOLLUSCA.



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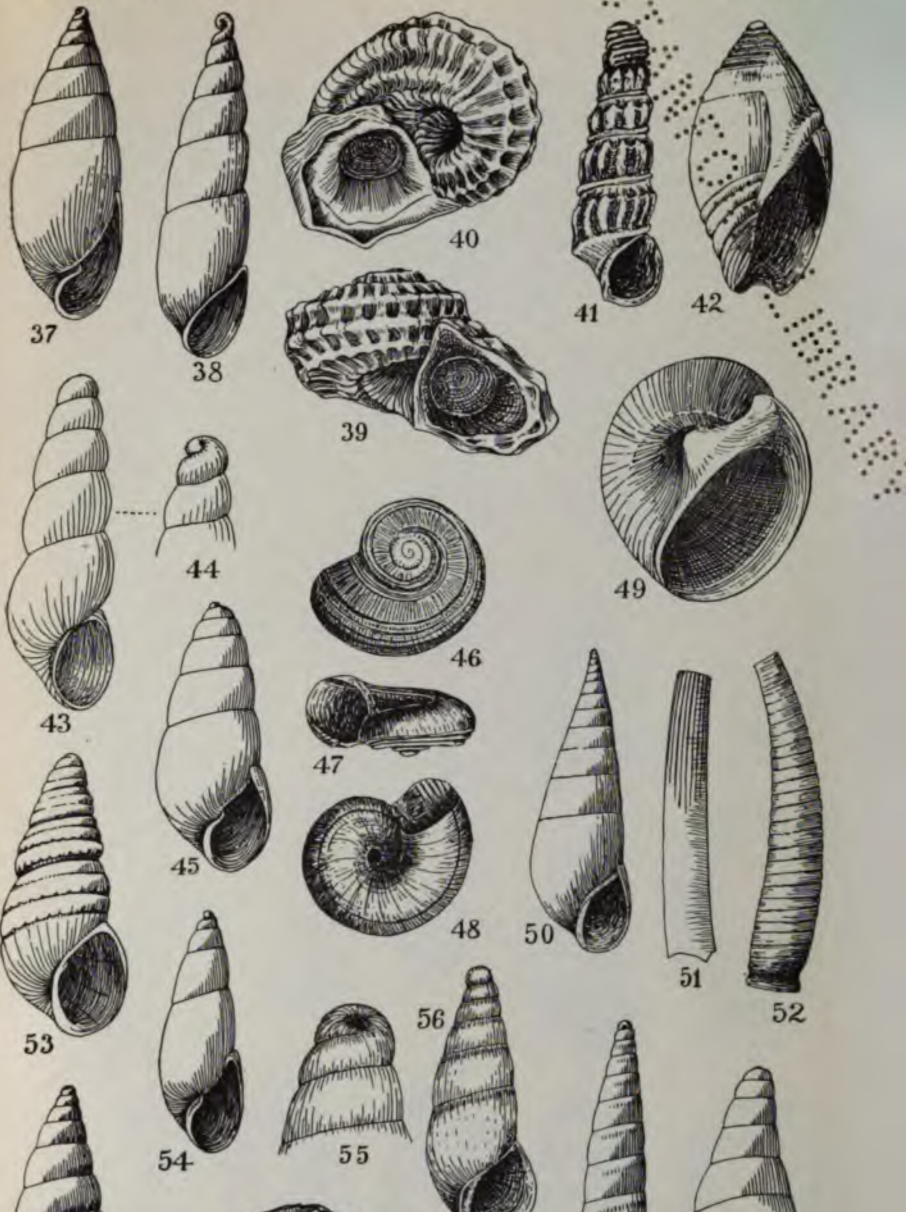

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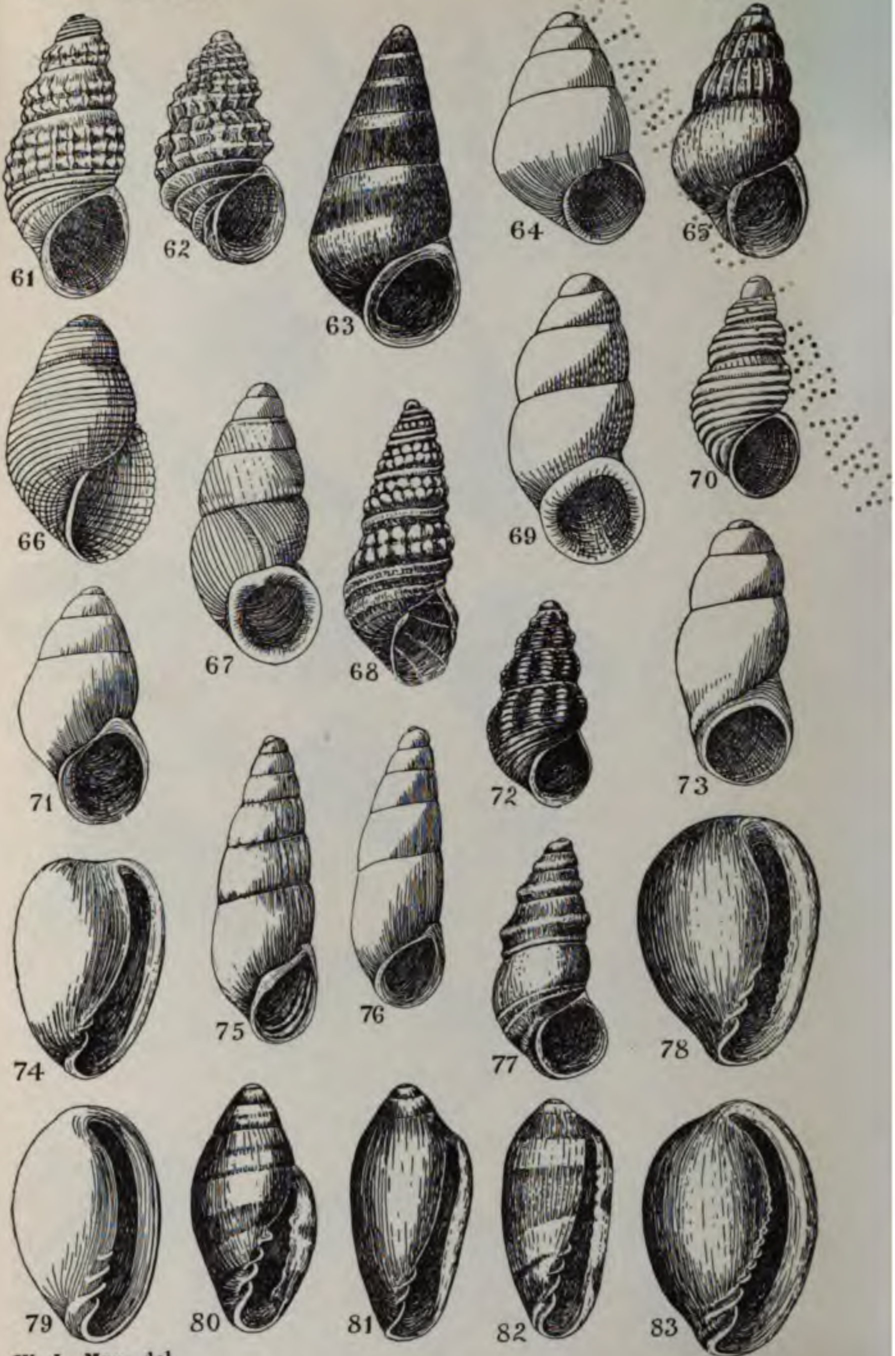

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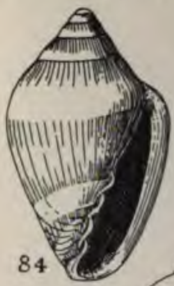
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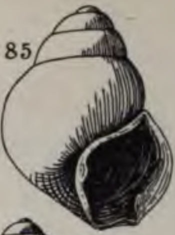
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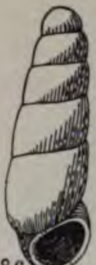
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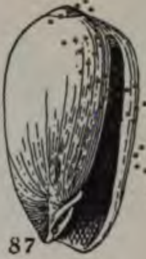
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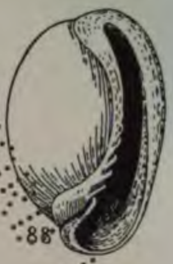
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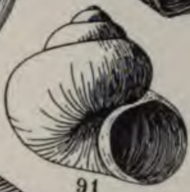
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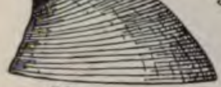
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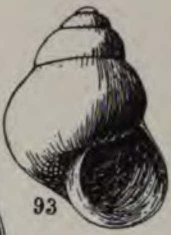
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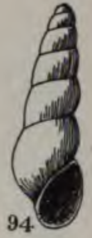
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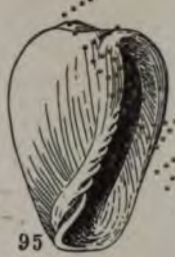
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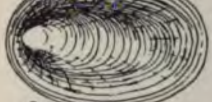
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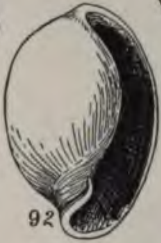
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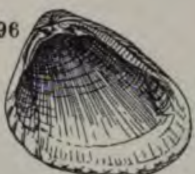
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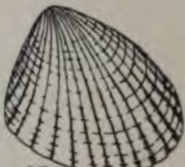
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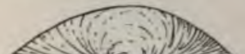
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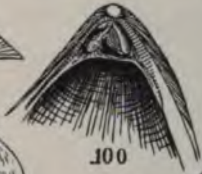
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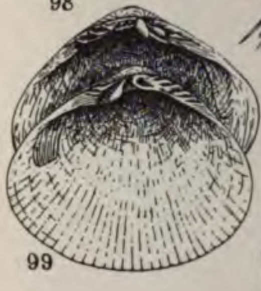
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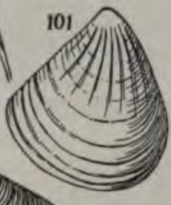
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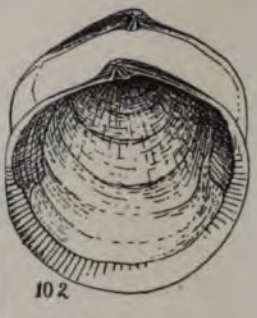
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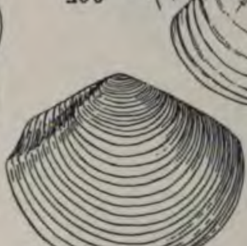
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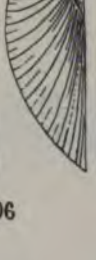
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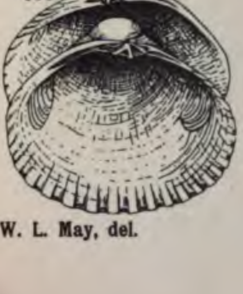
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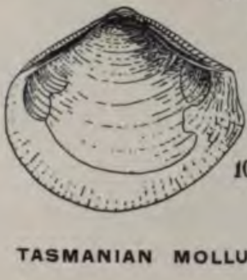
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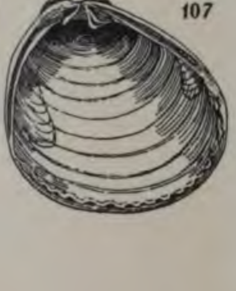
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W. L. May, del.

TASMANIAN MOLLUSCA.

P. L. S. N. S. W. 1901.

Pl. XXVIII

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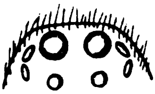

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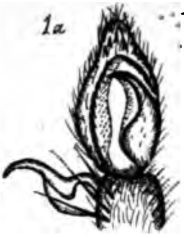

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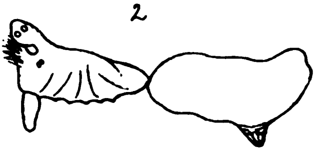

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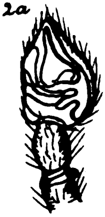

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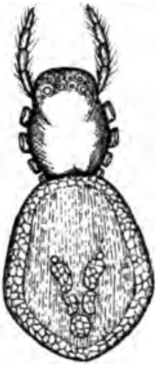

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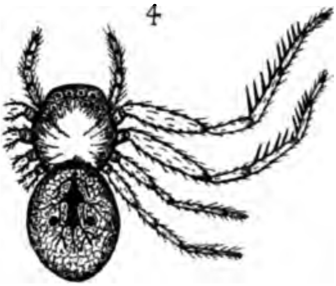

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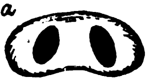

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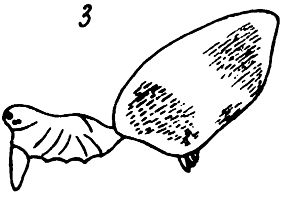

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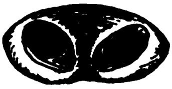
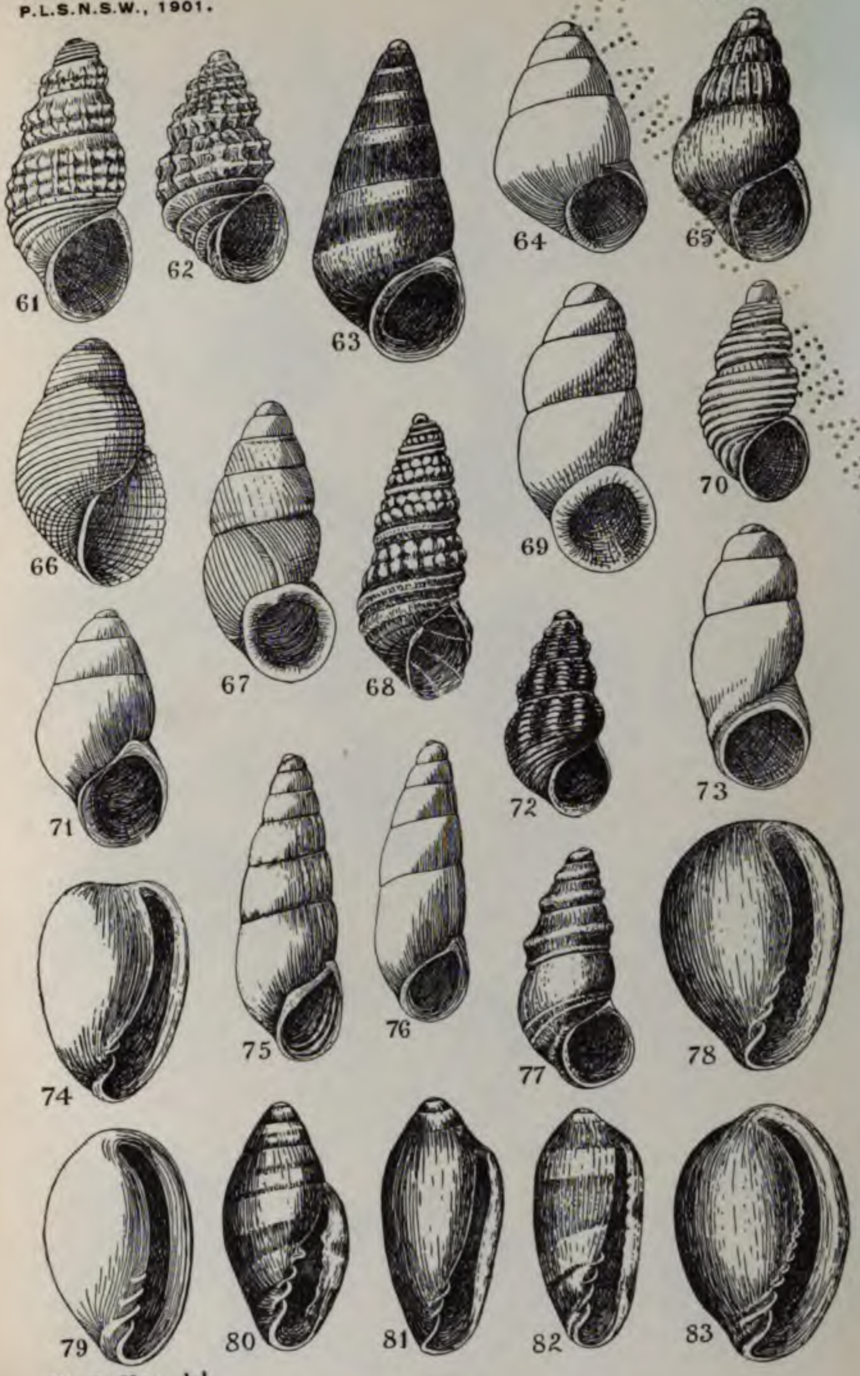


W. J. R. del.

SOUTH SEA ISLAND ARACHNIDA



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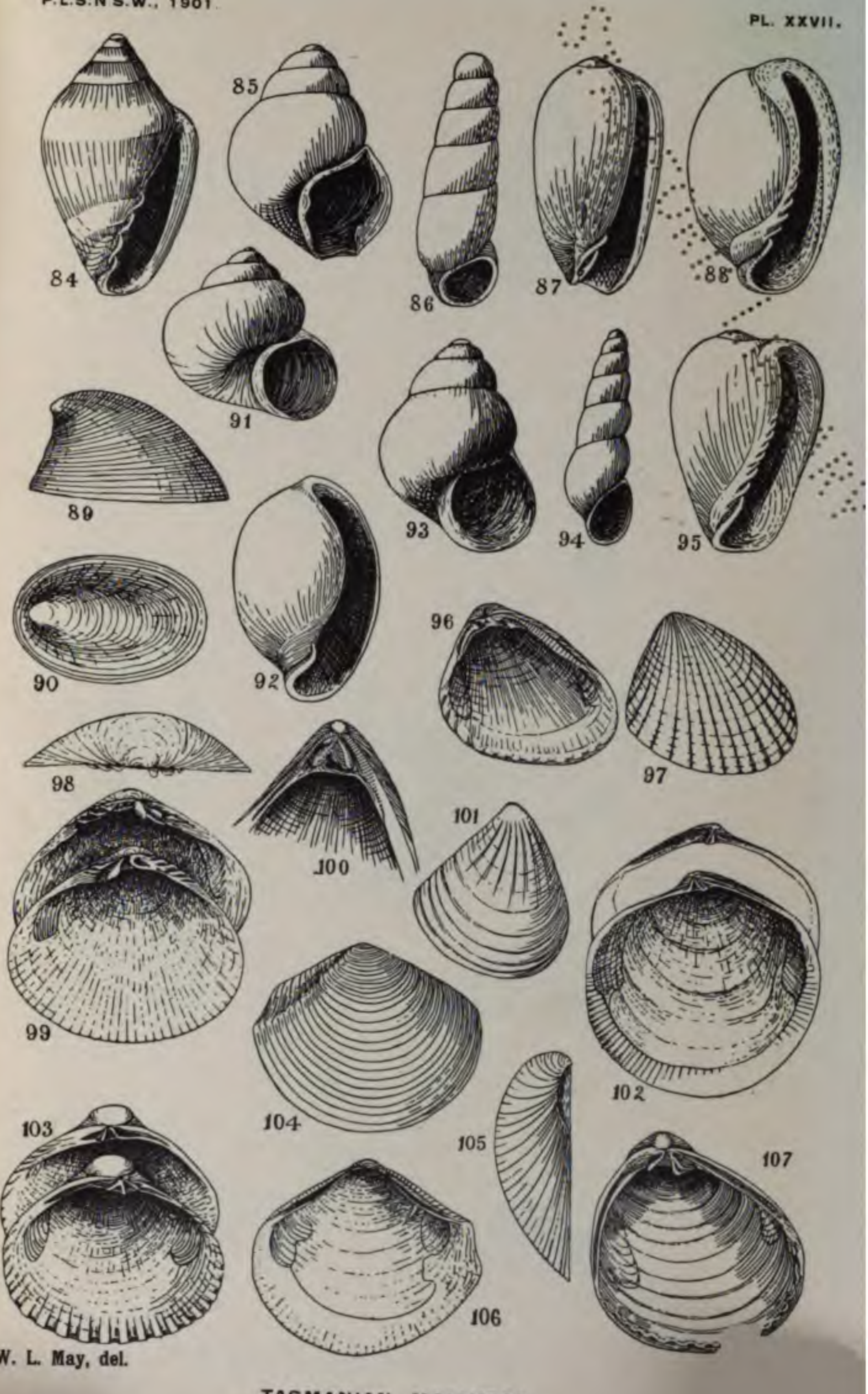
TASMANIAN MOLLUSCA.



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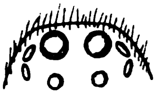

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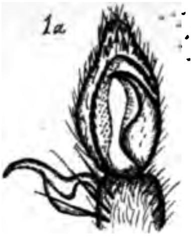

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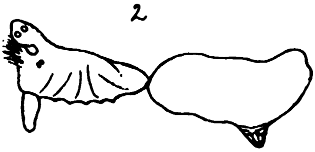

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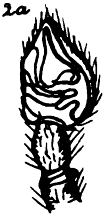

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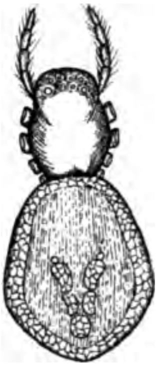

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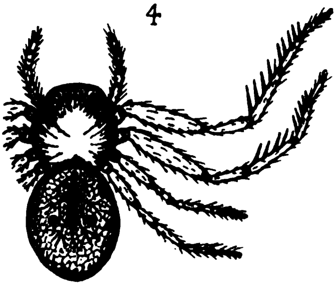

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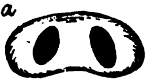

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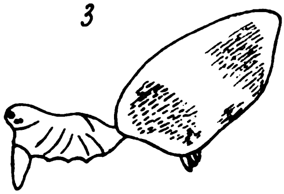

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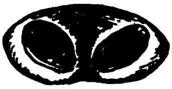

W. J. R. del.

SOUTH SEA ISLAND ARACHNIDA

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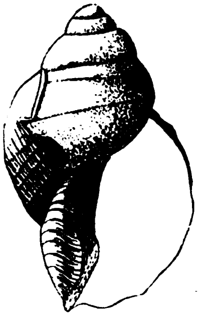
S.W. 1901.



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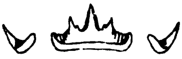

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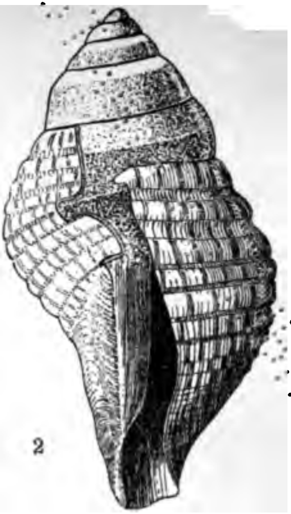

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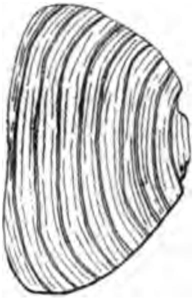

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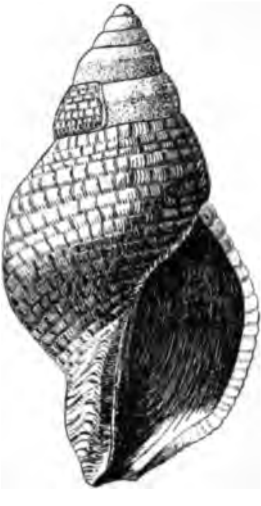

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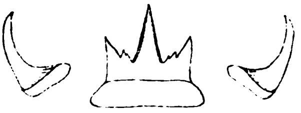

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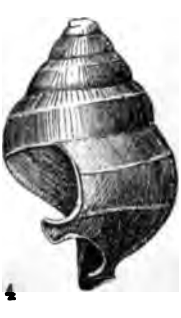

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PURPURA

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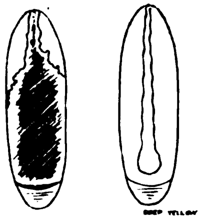

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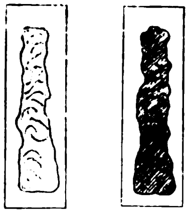

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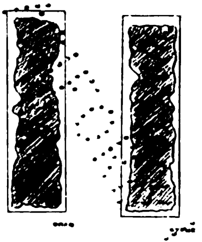

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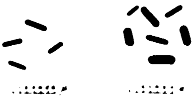

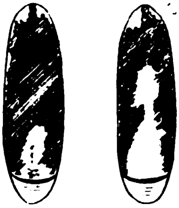

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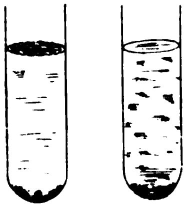

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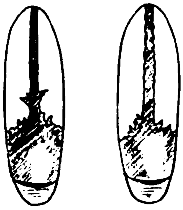

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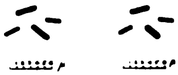

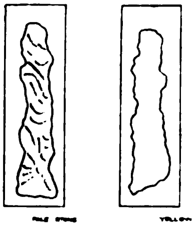

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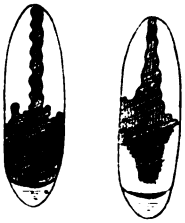

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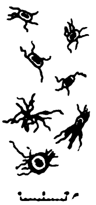

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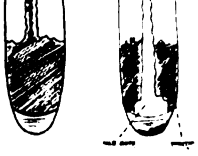

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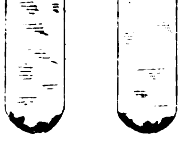

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GREIG SMITH DEL.

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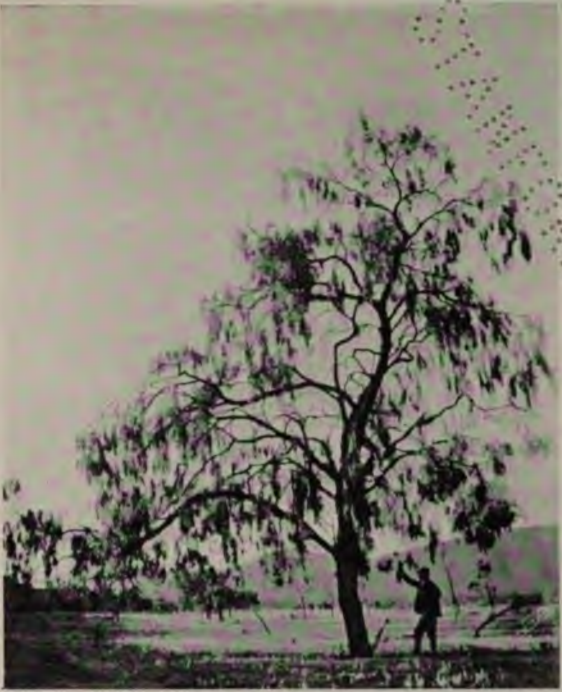

Fig. 1.
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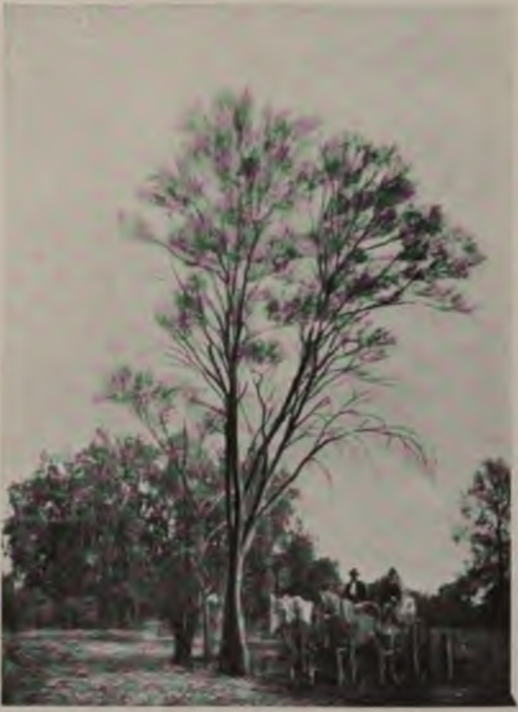

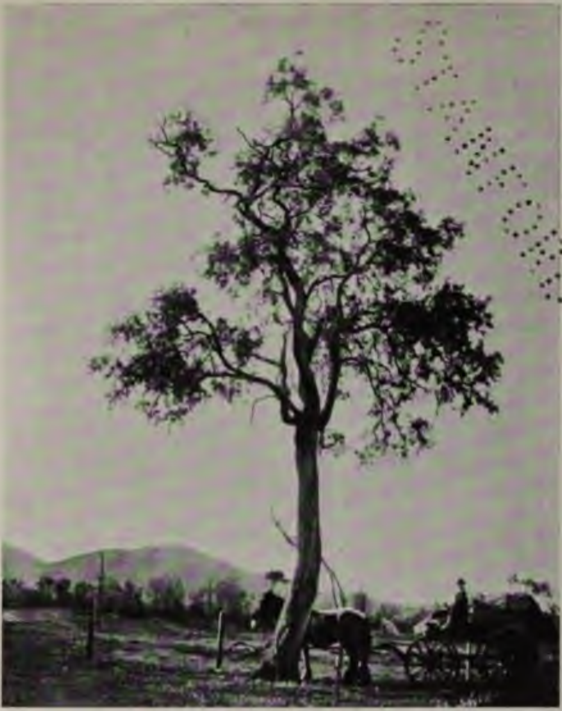

Fig. 1.
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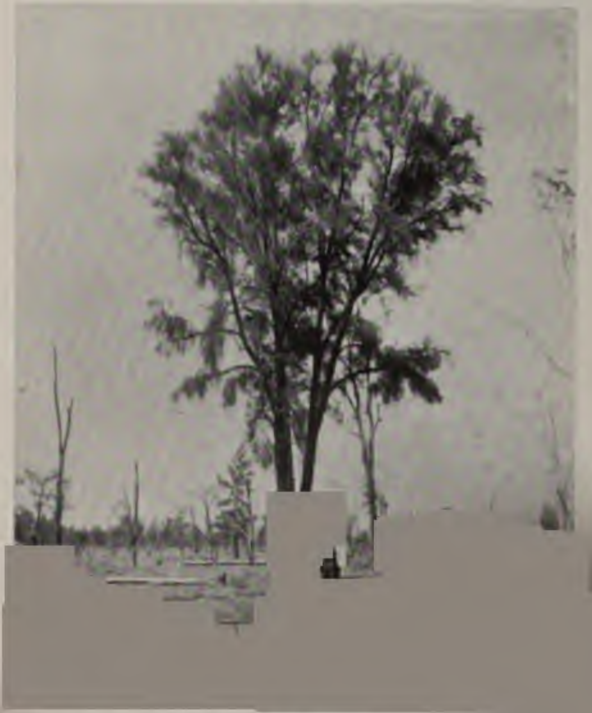

Fig. 2.
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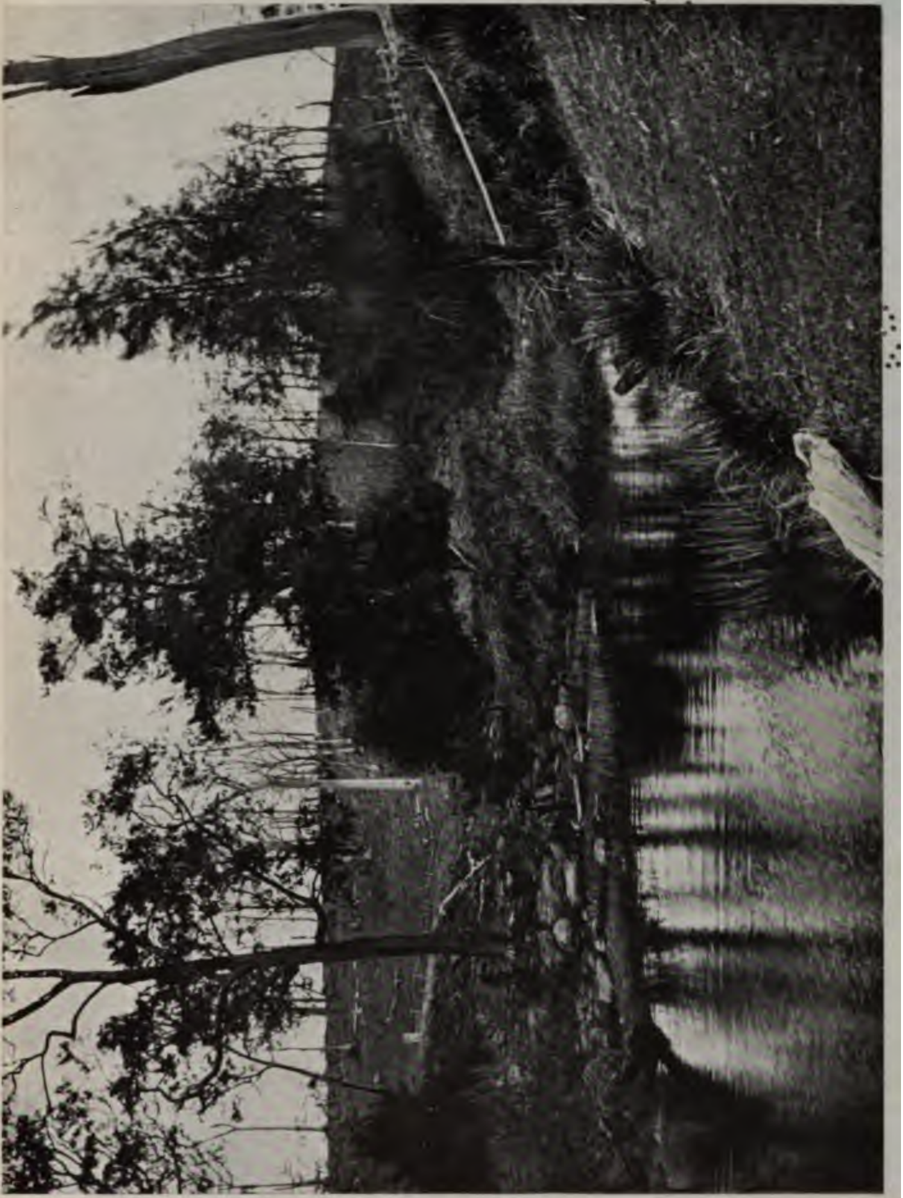

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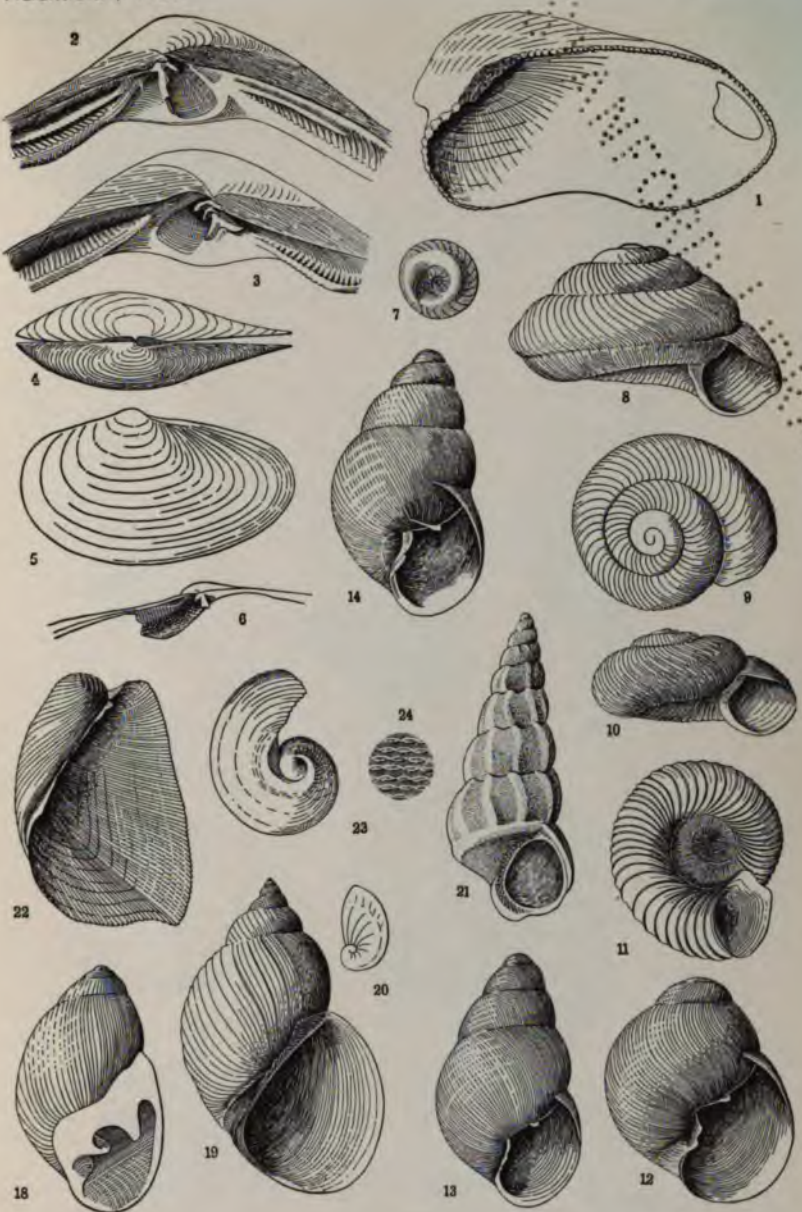
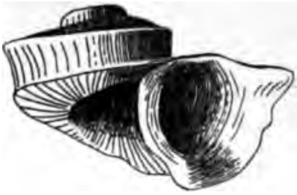


C. Hedley del.

AUSTRALIAN MOLLUSCA.



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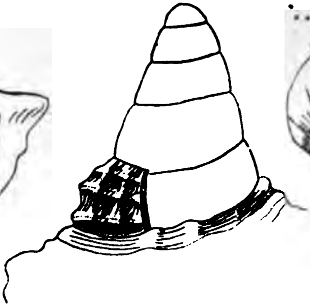

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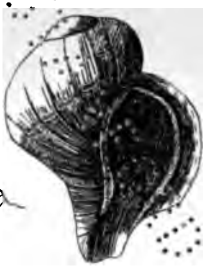

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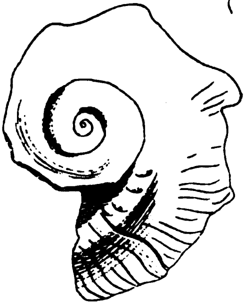

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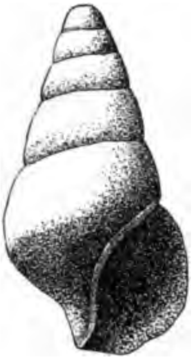

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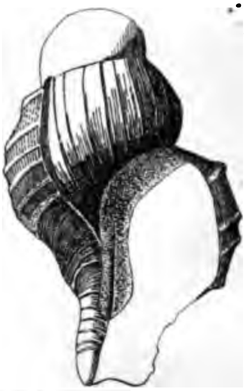

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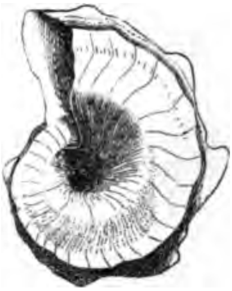

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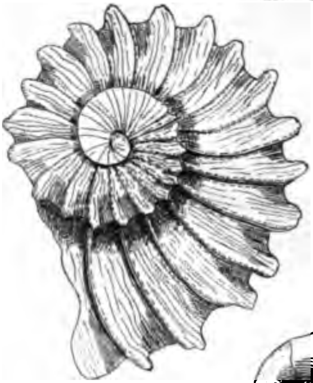

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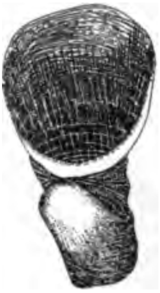

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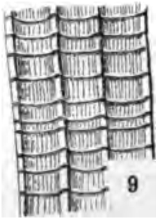

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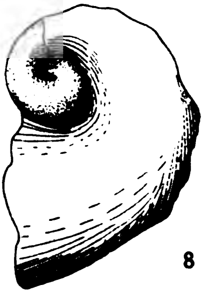

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PORT JACKSON GASTEROPODA

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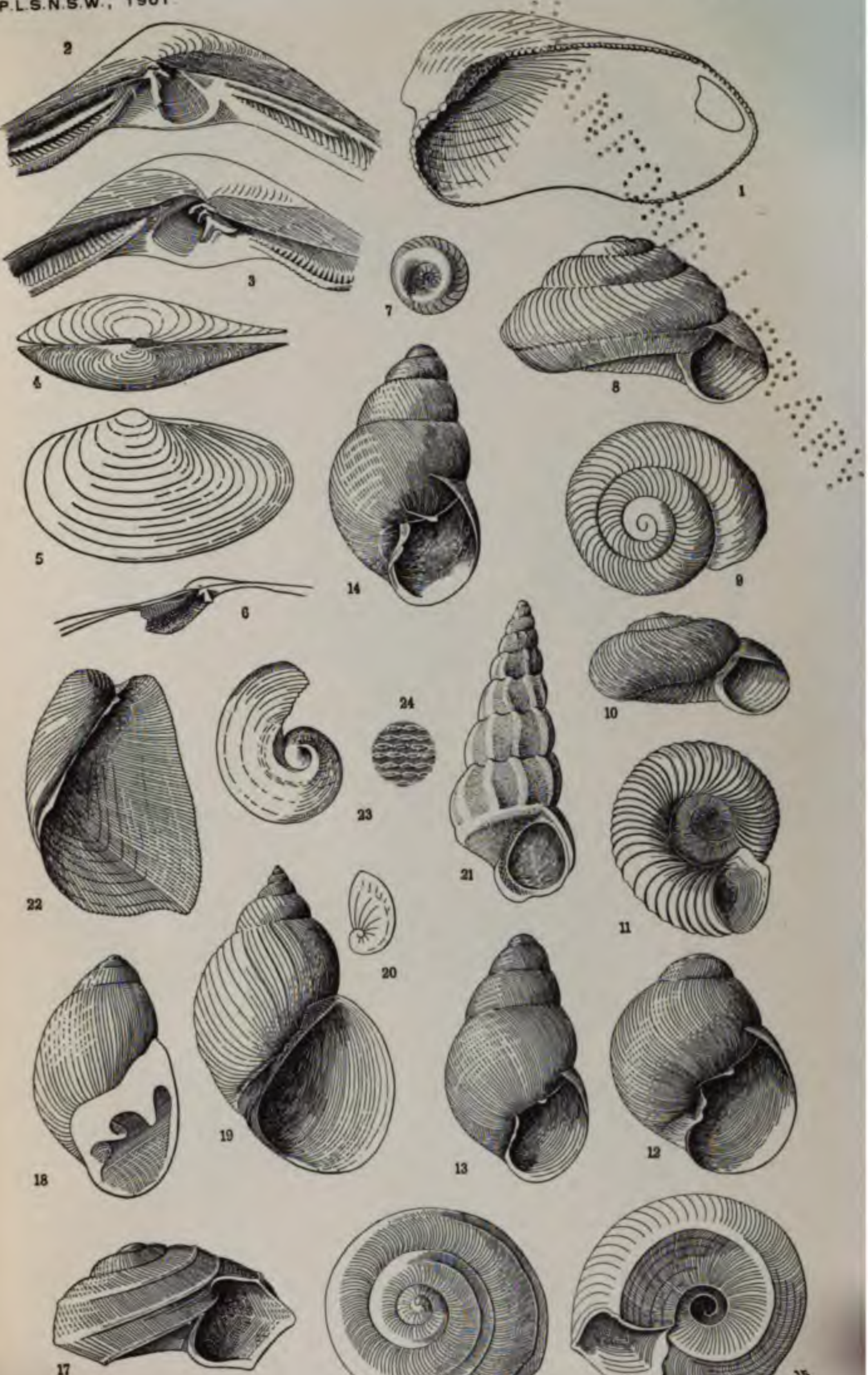
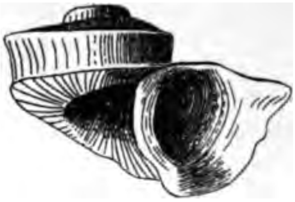


C. Hedley del.

AUSTRALIAN MOLLUSCA.



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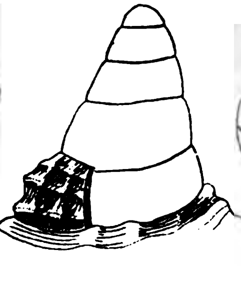

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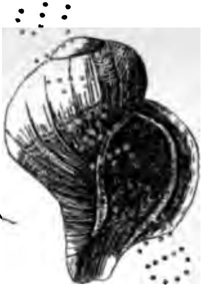

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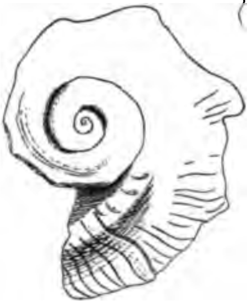

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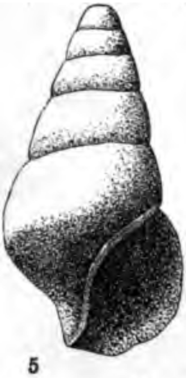

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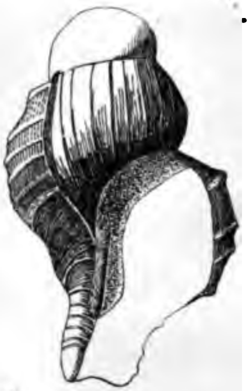

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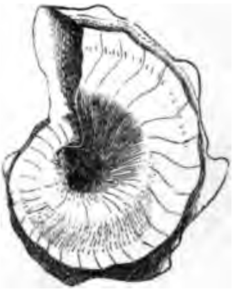

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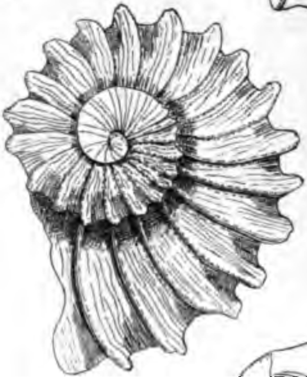

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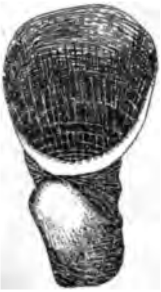

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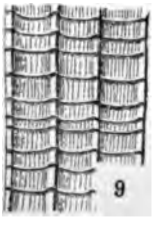

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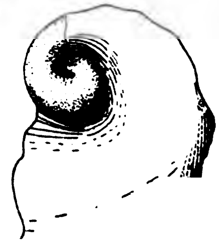

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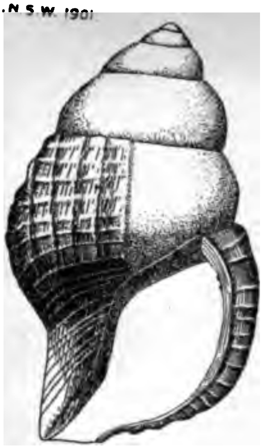
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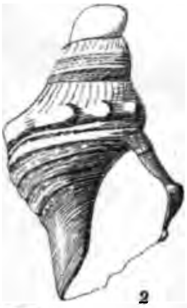
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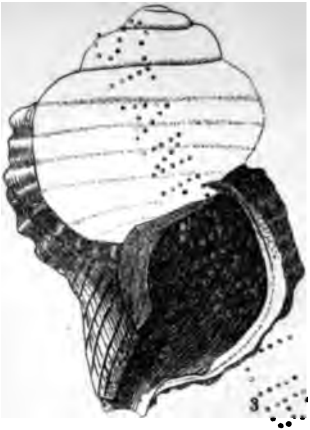
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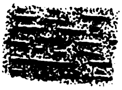
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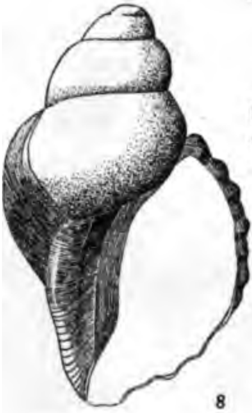
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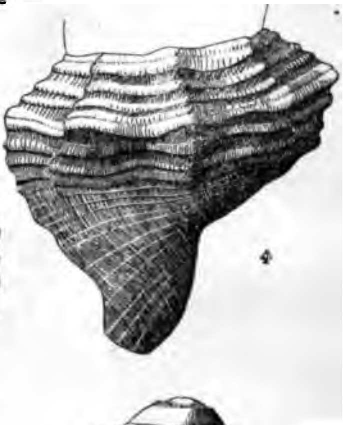
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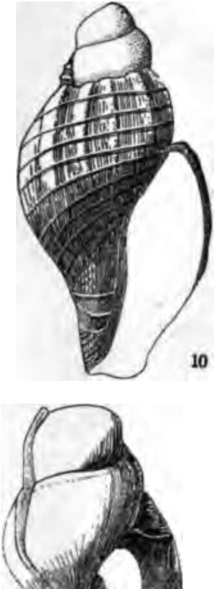
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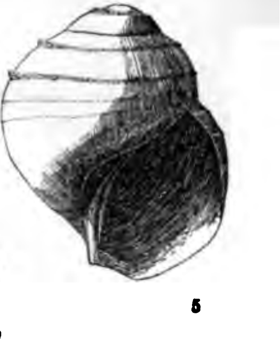
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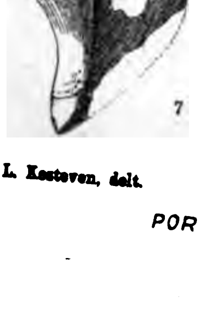
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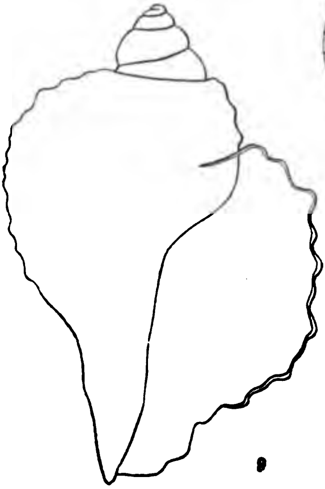
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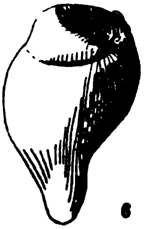
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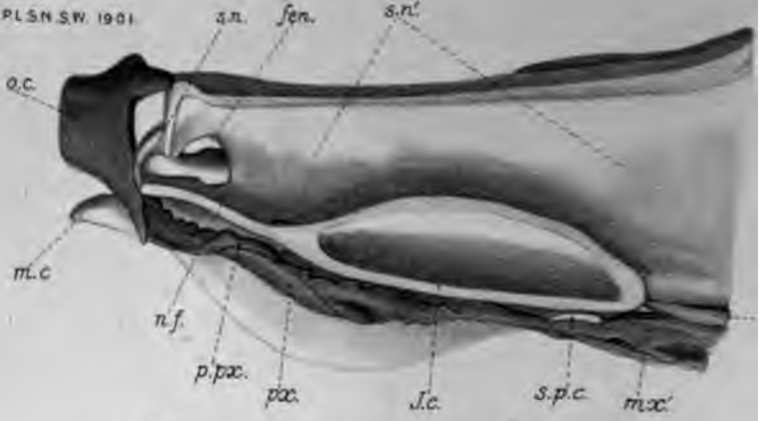

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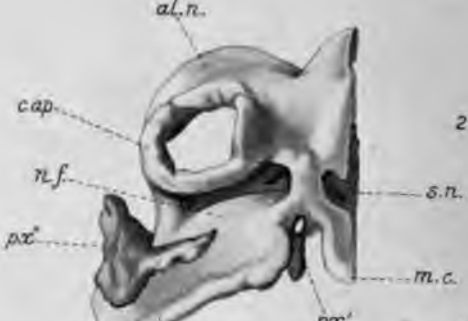

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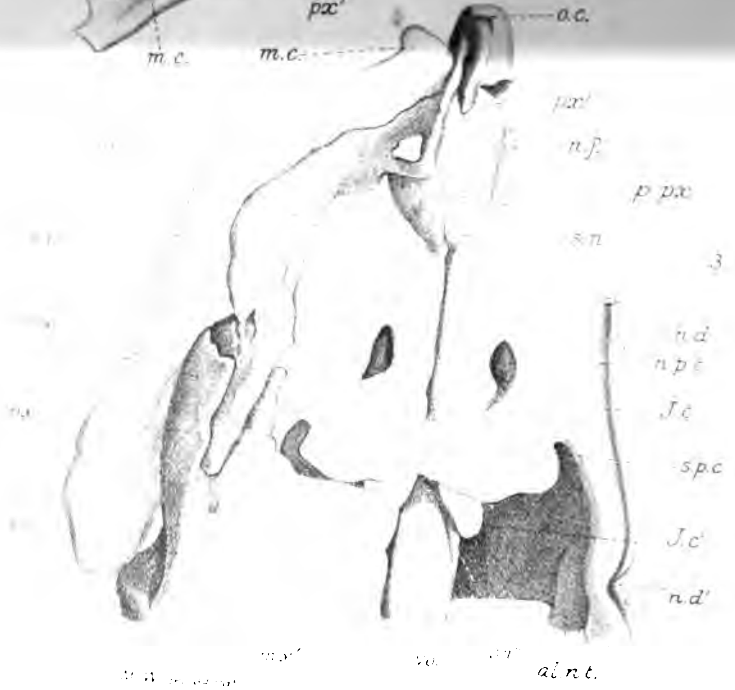

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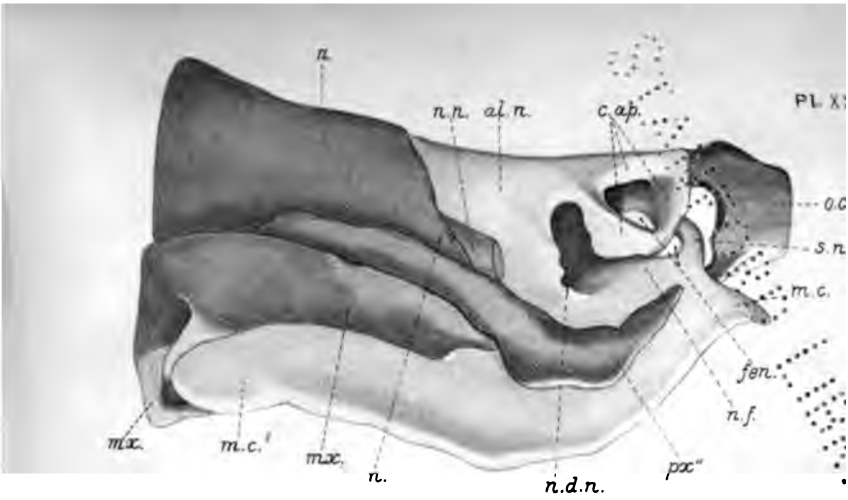

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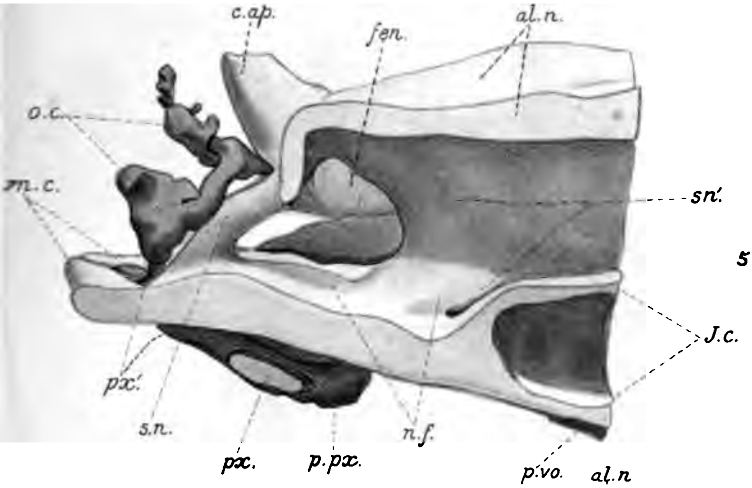

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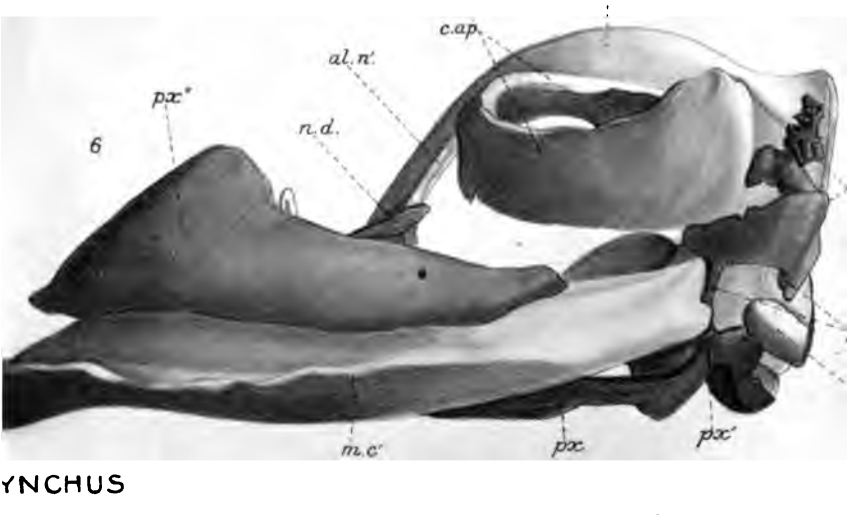

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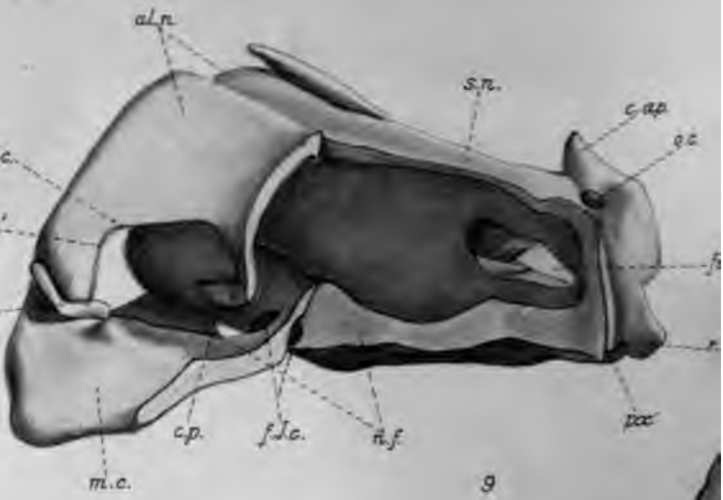

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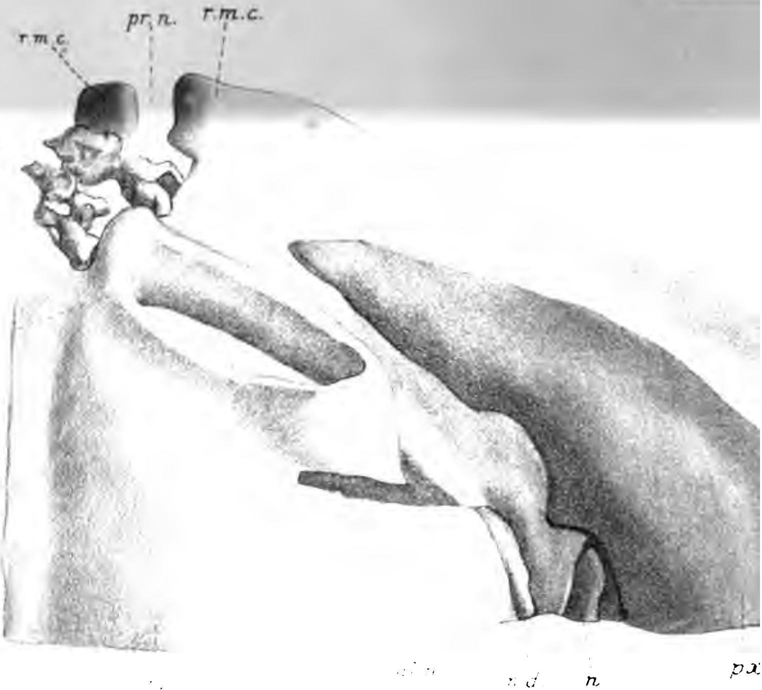

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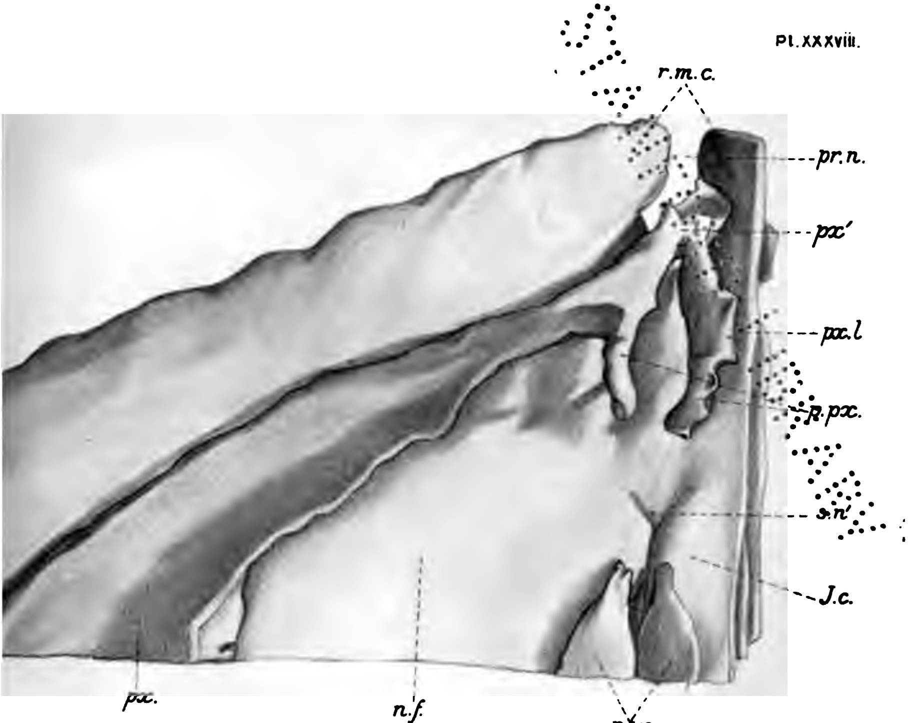

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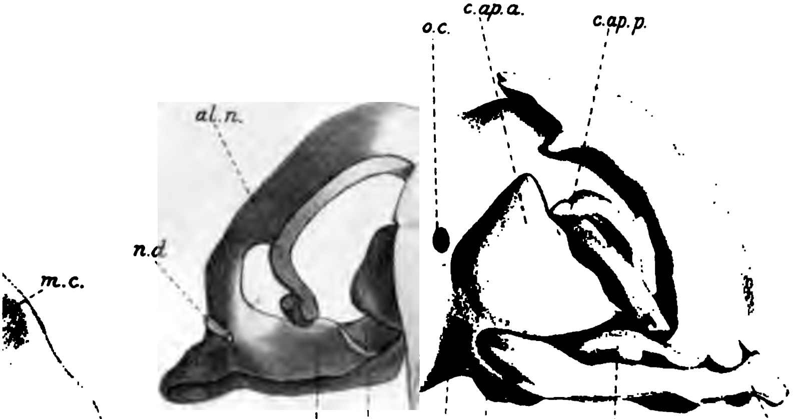

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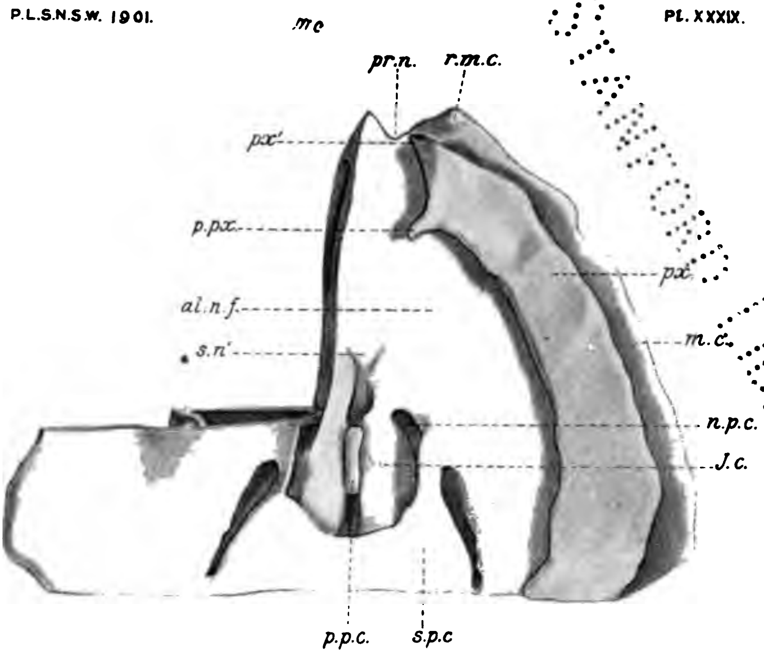

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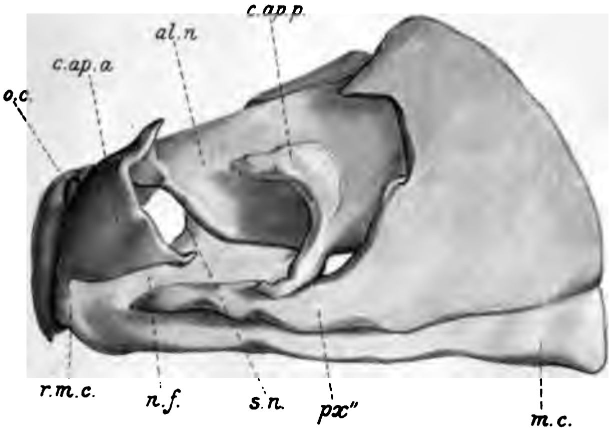

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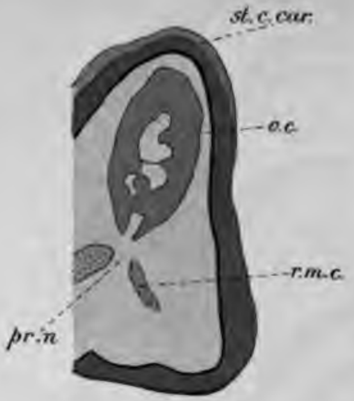

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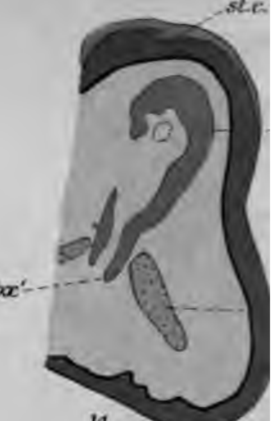

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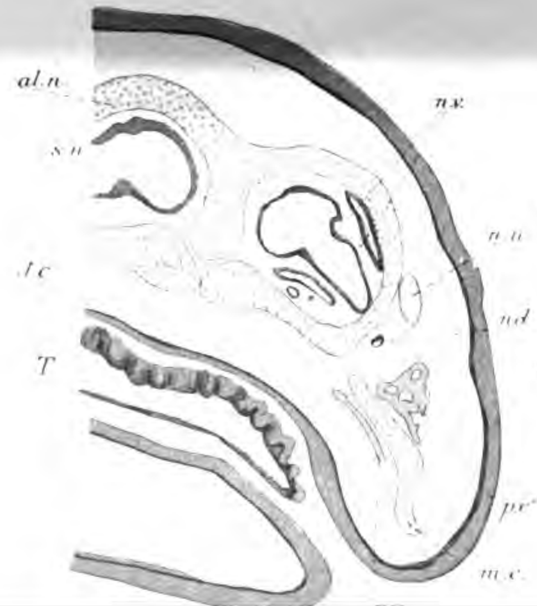

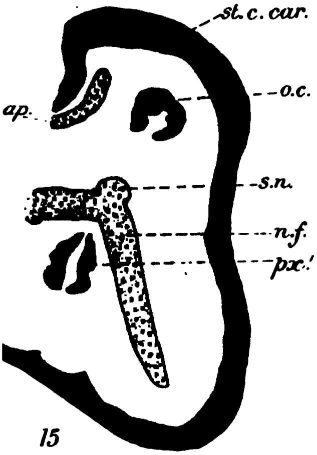
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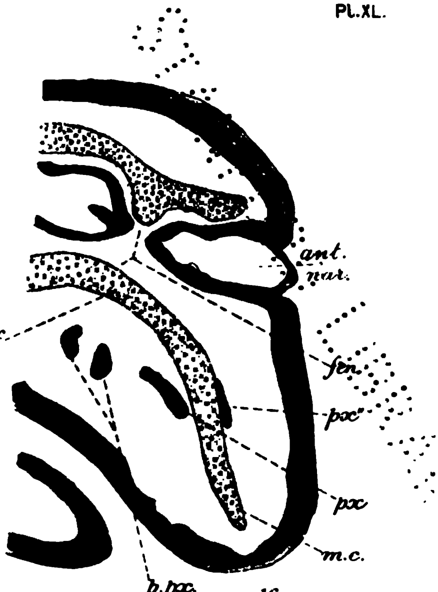
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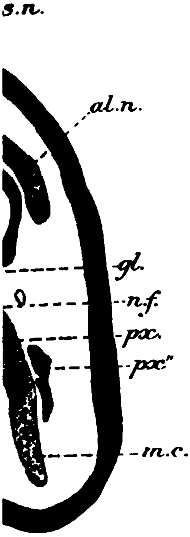
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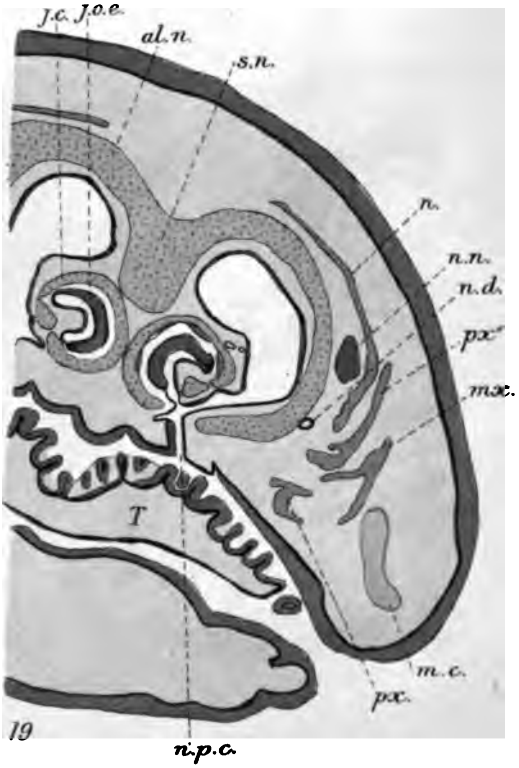
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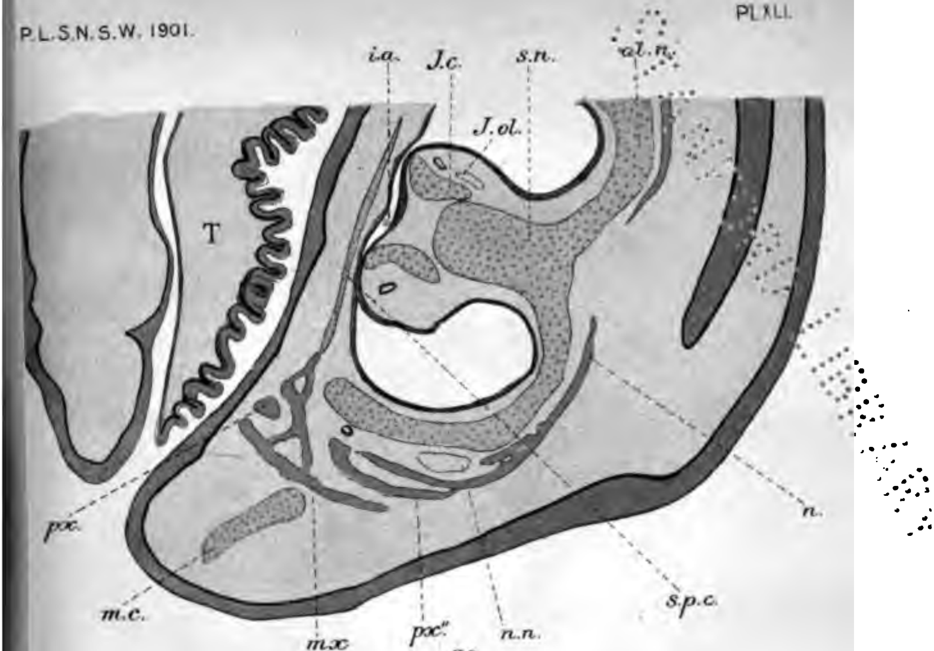

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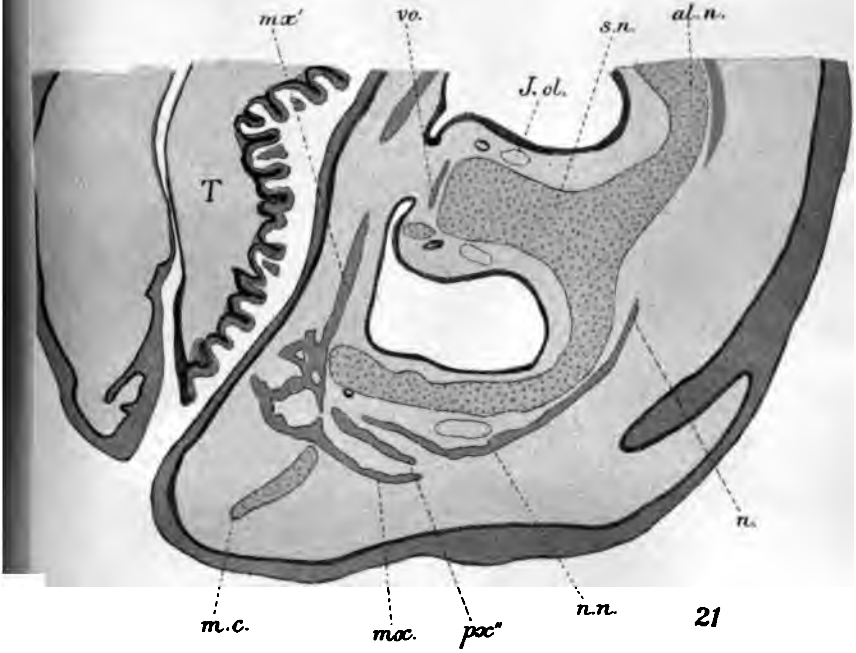

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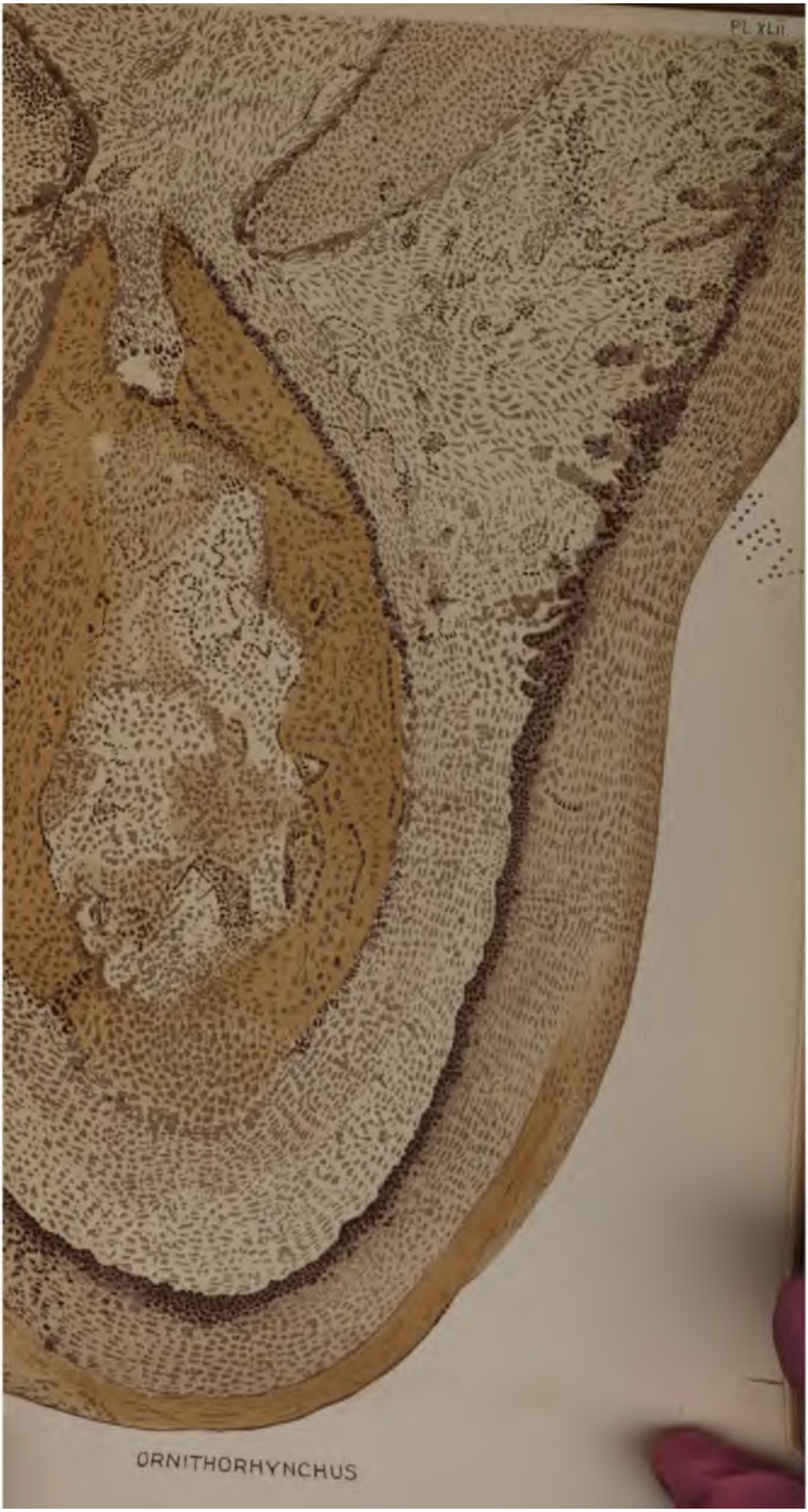

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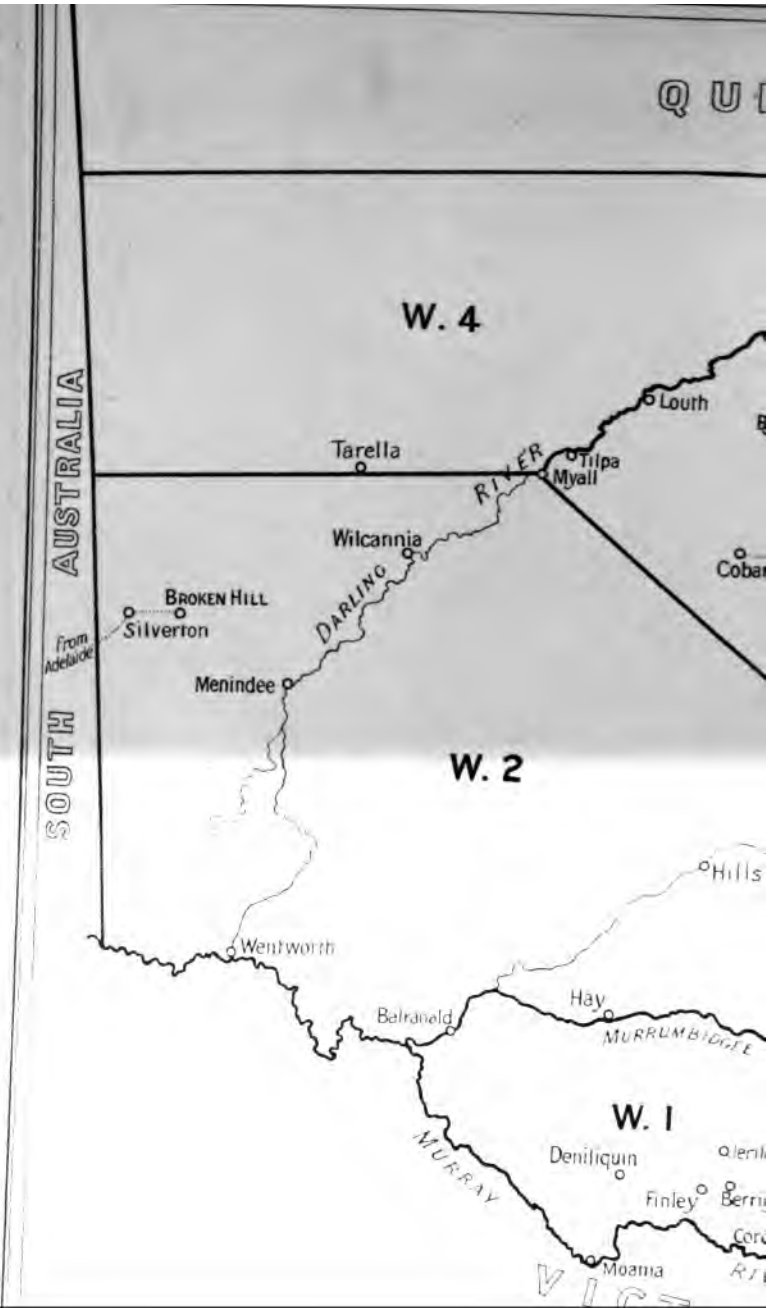
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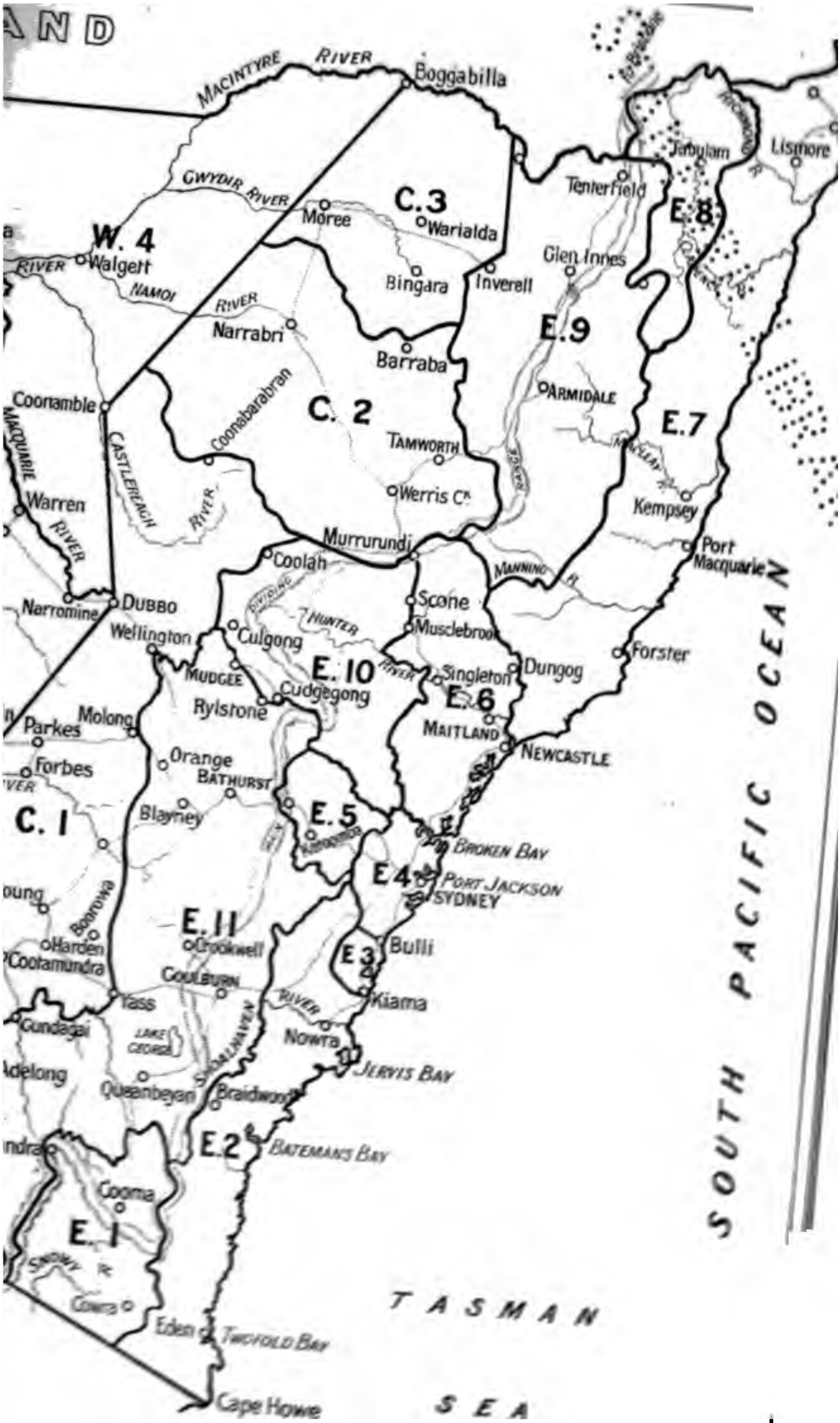

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i.—INTRODUCTION.

Until 1878, the date of publication of the
Woods's "Census," (Proceedings Royal Society of
1877), nothing whatever had been done towards a
of the Mollusca of Tasmanian waters. In that C
the basis of the present essay, the author collated
which had been attributed to Tasmania and includ
number of new species diagnosed by him in earli
tions to the same Society. Messrs. Petterd and Be
dates separately contributed descriptions of ne
Mollusca. All the aforesaid new species rem
except a few which were very indifferently illustra
"Manual of Conchology."

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